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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES

129 - **Development of Natural Resources in Portuguese East Africa** — HALL, H. H. (H. B. M Consul-General Laurenço Marquès) in *Department of Overseas Trade Report on the Commercial Situation of Portuguese East Africa*, London, 1922.

As regards agriculture, in which the country throughout is extremely rich there is great activity, particularly on the banks of the Zambesi and in the district of the Companhia de Moçambique, which is served by the port of Beira. On the Zambesi, as well as in the southernmost part of the country, sugar is produced in large and increasing quantities. The average annual amount exported during the last few years has been forty thousand tons. Some of the land under sugar-cane is said to give an average of forty-five tons of cane to the acre. In the territory of the Companhia de Moçambique land has been and is being taken up for the growing of maize, rice, tobacco, oil-seeds and other crops and for the rearing of cattle. The maize is stated to average fourteen bags to the acre. Towards the north of the country various large undertakings are actively extending coconut, sisal and other plantations, with machinery for treating the product for export. In the inland district of Tete, which lies between the Nyasaland Protectorate and Northern Rhodesia, a British company with headquarters at Capetown has quite recently started works for the manufacture of pulp from baobab trees.

Much attention has recently been paid by the Government of the country to the possibility of irrigating various suitable areas, notably in the valley of the Limpopo, where it has been found that there are about one hundred and fifty thousand acres of excellent alluvial land about forty miles from the sea, that can be irrigated, drained and protected from

[Abstract No. 1129]

floods : a small river which is navigable for small ocean-going steamers runs some way into the area. Schemes are also being submitted for simila treament of various areas in the valley of the Incomati River, amountin to about one hundred thousand acres in all.

A. d. B.

1130 - **Agriculture in Nigeria in 1921.** — FAULKNER, O., in *Nigeria Annual Report o the Agricultural Department for the year* 1921. 8 pp. Lagos, June 14 1922.

Cotton. — The American cotton bush (" Allen ") was introduce from Uganda into the Province of Zaria and the neighbouring Province of Kans and Sokoto. Almost all the crop of 1921 in the northern Pro vinces, 10 000 bales, was American cotton, while in the previous year, ou of an almost equal yield, there were only 5 500 bales of American cotton The cotton is bought by the British Cotton Growing Association whic paid from 1915-1916 to 1921-1922 respectively 1 3/4 — 1 3/4 — 2 3/4 - 2 3/4 — 3 1/2 — 4 1/2 — 2 pence per pound for unginned America cotton. The Agricultural Department encourages the development o cotton growing by distributing selected seed (about 2300 kg. in 1921) by inspecting the cotton brought to market. stations, which is said t decrease the difference between the price offered by the British Cotto Grower's Association and that paid by agents and brokers ; by the selectio of " Allen " cotton, which has already given encouraging results.

Cotton is the principal product exported from Northern Nigeria

Cotton is very extensively grown in Southern Nigeria : in 1920-1921 20 000 kg. of unginned lint were exported, which formed only a small part of the total output as a good deal is used by the natives for home weaving. In 1921-22, the export was only about 1/4 of that of the previous year, owing to the unfavourable season and the low price offered (1 1/4 pence per pound). In previous years the Agricultural Department had distributed seed of " Georgia " Cotton in Southern Nigeria ; in 1921, it distributed seed of " Allen " cotton (6860 qx.) brought from Northern Nigeria. This large scale experiment has not given definite results as the year was unfavourable : the inspectors at the market stations noticed some good lots of cotton grown from this seed, but much of the lint was not sufficiently ripe and was blemished.

Cultural experiments undertaken at the Moor Plantation of the Agricultural Department have not given conclusive results. The yield of the " Allen " variety was poor, but that of indigenous cottons was still less. Researches must therefore be renewed for the purpose of discovering a cotton suitable for growing in Southern Nigeria. The Department has already begun such work which includes : — Selection of native cotton ; experiments with a few good exotic cottons ; experiments to decide which is the best time for sowing.

Similar remarks apply to the Province of Florin.

Cocoa. — The cocoa tree was introduced into the Provinces of Calabar, Berrin and perhaps Onitoha also, long before it was of any importance for the Colony or for the old western Provinces. The quantity exported

rose from 1388 t. in 1908, to 18 232 t. in 1921, of which about 17 420 t. were exported from Lagos.

The cocoa exported from Lagos is grown very close to the coast or to the north-east of Iladan, while in the intervening country there is little or none. This is due, among other reasons, to the climate, soil, railway, character of the people, etc., but specially to the action of the Southern Nigeria Agricultural Department: cocoa growing has only gained a oting in places where it is likely to be permanent. It is encouraged y the teaching of good methods of fermentation. Moreover, up to the larch 31, 1921, 16 000 cocoa plants were distributed free of charge or old and 272 000 beans were distributed gratis for sowing.

During 1921 the corresponding figures were 1500 plants and 5200 eans.

Oil Palm. — The methods which have been suggested and discuss- d by several authorities and commissions in agreement with the Colonial ffice to increase the production of palm oil and drupes or to improve the uality of the oil are chiefly: — 1) The introduction of machinery to eplace the native methods of extraction. 2) Improvement of local ethods of extraction, which vary in different places. 3) Production nd propagation of improved varieties. For Nigeria the first is the most nd the last the least important matter; but it is the latter which has lone attracted attention.

Of the different varieties sown at the Moor Plantation, Calabar, Omit- ha and Benin have begun to bear. In all plots, except those plant- d with the common local variety, the palms are too few to make any stimate as to their yield. The varieties are not clearly characterised nd besides those described in the text-books, intermediate forms are also et with.

Kola nuts. — For many years the Agricultural Department has encour- ged the plantation of the "Gbanja" variety of kola, and has distri- uted altogether 212 000 nuts and 58 000 plants of that variety, of which 14 000 nuts aud 8216 plants were distributed in 1921. The output of he southern Provinces is at present scarcely sufficient to support a regular rade, but the yield of the "Gbanja" variety which was introduced from he Gold Coast, is steadily increasing.

Tobacco. — Light Virginian tobacco has been grown in Florin, but p to the present time only partial success has been obtained.

Rice. — Ceylon swamp rice has, to a great extent, replaced local arieties in many parts of the Northern Provinces. At Pategi (Florin rovince) a variety introduced from Guiana has been tested comparat- ely with the Ceylon rice; the results are encouraging.

Other crops. — A certain amount of success has been obtained, espe- ially in the Northern Provinces, in the introduction of better exotic arieties, or in the selection of indigenous varieties of various cultivated lants, such as "guinea corn" (a variety of sorghum for grain), wheat nd "coco-yams".

The Agricultural Departments of Southern and Northern Nigeri have been united into a single Department with the writer at its heac

F. D.

1131 – **Agriculture in the State of Bahia, Brazil** (1). — BARBOSA DE SOUZA, Y. (Secretario da Agricultura, Industria, Commercio, Viação e Obras publicas do Estado d Bahia), *Relatorio apresentado ao Exm. Sn. Dr. J. J. Seabra, Governador do Estad* Year 1920, 181 pp., 7 full page tabl. Bahia 1921.

PRINCIPAL CROPS: *Cotton.* — The "Serviço do Algodão" (Cot tons Service) was instituted by Federal Decree No. 14 117 of March 2 1920 for the encouragement of cotton growing. The "Centro Industri do Algodão", which collaborates with the former in the control of "La garta rozada" (*Gelechia gossypiella*) (2), and of "Lagarta verte" help in the same object.

Sugar-cane. — The crop might be much more widely grown. I 1919 and 1920 the sugar factories of the State produced 372 700 bag of sugar.

Maize. — This is one of the most extensively grown cereals an thrives well throughout the State. It covers about 150 000 ha. yiel ing about 2 100 000 qx. a year.

Cocoa. — Exported in large quantities this commodity forms on of the principal sources of wealth of the State. According to the "Sy dicato dos Agricultores do Cacau" production reached a maximum 814 412 bags of beans in 1918, but fell to 786 074 bags in 1919 an to 650 873 bags in 1920.

Other important crops are *tobacco, coffee, manioc, rice,* etc. Th export trade is almost exclusively maintained by agricultural product In 1920 it included: — 53 667 000 kg. of cocoa — 30 288 000 kg. tobacco — 656 7000 kg. of coffee — 6 512 000 kg. of sugar — 2 765 0 kg. of leather and 750 000 kg. of hides — 2 525 000 kg. of "piassava — 180 t. of timber — 58 000 kg. of rubber — etc.

The forests supply almost all the fuel (firewood and charcoal) co sumed by the railways, shipping, factories and required for domestic us Owing to heavy timber cutting the question of reafforestation arises; th writer suggests the formation of forest nurseries for this purpose.

AGRICULTURAL ENCOURAGEMENT. — Includes: — distribution seeds, competitions with prizes, sales to farmers at cost price of plough and other agricultural implements, etc. The distribution of seeds an plants is entrusted to the "Inspectoria do Serviço Agronomico" (I spectorate of the Agricultural Service) and to the Bahia experimental an demonstration Staff. The seeds distributed in 1920 were chiefly garde seeds, cereals and seeds of leguminous forage plants.

PUBLIC AGRICULTURAL SERVICES. — These include: — agricultu stations — a station for experiments and demonstrations — a meteor

(1) See *R.* July 1922, No. 681, Note (1). (*Ed.*)

(2) See *R.* Dec. 1921, No. 1306. (*Ed.*)

ical Service — the publication of the *Boletim de Agricultura* of the Secariat of Agriculture, Industry, Commerce, etc. In 1920 about 1200 ies were distributed.

The cadastral map is being compiled ; this is entrusted to the " Sero de Terras " of the " Directoria de Terras e Minas ".

AGRICULTURAL EXPERIMENTS. — These are entrusted to the " Campo Experiencia e Demonstração Dr. Antonio Moniz " at Bahia, the area which is about 4.5 ha. In 1920, many varieties of pulse, cereals, forage nts, industrial plants, pot-herbs and vines were tried. Among other ngs it was noticed that the " Bento Vieira " variety of manioc could upy the ground for 10 years and produce enormous roots which ched a length of 2.80 m. and weighed as much as 13 kg.

The " Florida beggar weed " (*Desmodium tortuosum*) did very well its propagation in Brazil as a forage plant and green manure has sequeutly been recommended.

AGRICULTURAL INSTRUCTION. — Is entrusted to the " Aprendizado icola Federal " of Villa de São Francisco and to the " Escola Agricola Bentos das Lages " of Villa de São Francisco, founded in 1859, which fers the diploma of " engenheiro agronomo ".

BREEDING. — According to official statistics the State of Bahia conis : — 2,683 000 cattle — 825 000 horses — 587 000 donkeys and mules 3 005 000 goats — 2 224 000 sheep — 2 410 000 pigs. The cattle sheep are bred for slaughter.

There is a Federal Veterinary Inspectorate (" Inspectoria Fedede Veterinaria ") in the State. Good breeding animals are to be chased shortly and sold to breeders at cost price in order to found ostos zootechnicos " (Zóotechnical Stations), serving stations and to inge for dipping.

MEANS OF COMMUNICATION. — 2000 km. of railway are in use and km. are under construction and plans for the construction of 1700 km. e been approved.

The river and coastal shipping is subsidised by the State. The conuction of about 350 km. of roads has just been undertaken.

The building of important hydro-electric power stations (on the Parassú, Jaguaripe, Italhipe and the Una) has made it possible to begin construction of electric tramways and telephone lines.

COLONISATION AND IMMIGRATION. — The State of Bahia took part he recent negotiations with the Italian Goverument with the object of buraging immigration to its territories, where agriculture can be conrably developed. F. D.

- Destruction of Mosquitoes by Eels (1). — DUBOIS, R., in *Comptes rendus hebdomadaires des séances de l'Académie des sciences*. Vol. 175, No. 10, pp. 431-432. Paris, Sept. 5, 1922. RURAL HYGIENE

From experiments made by the writer it was found that young eels well for a long time in very impure water and that in such water they

(1) See *R.* March 1920, No. 282 and Feb. 1921, No. 115. (*Ed.*)

are very active in destroying the larvae of mosquitoes, and possibly also the eggs of several intestinal worms. They are so voracious at the commencement of spring that the writer no longer found any anopheles larvae in ponds where there had been large numbers before the eels were introduced.

The writer thinks that it would be very advantageous to keep young eels in all waters containing larvae of mosquitoes, both in the case of drainage water and other very contaminated waters. The exceptional hardiness of these fish, their low cost, the facility with which they can be caught and transported in large numbers, make them preferable to goldfish (which have been recommended for killing larvae) and suggest that they would be very useful for the control of malaria by natural means.

E. F.

1133 - **Effect of Aluminium Salts and of Acids in various Strengths on the Development of Plants in Water Cultures** (1). — CONNER, S. O. and SEARS, O. H. (Purdue University, Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 1, pp. 23-33, 1 fig., 4 full page tabl., bibliography of 8 publications. New Brunswick, N. J., Jan. 1922.

In spite of the large amount of literature dealing with the effects of aluminium salts and acids on plants grown in water, it has not yet been possible, owing to the great variety in the methods used, to compare the results obtained.

In 1919 the writers made a series of experiments on this question on rye, maize and barley grown on sand and then transferred to TOTTINGHAM nutritive solutions. The following substances were experimented with: — nitric acid, sulphuric acid, hydrochloric acid, phosphoric acid, tartaric acid and the respective aluminium salts at 4 different strengths, (N/ 600, N/ 1200, N/ 2400, N/ 4800); sulphate of aluminium mixed with phosphoric acid and the three phosphates of lime (N/ 600); sulphate of aluminium mixed with silicic acid; silicate of lime; carbonate of lime and of magnesium; dextrose; mannite; glycerine and carbon. Equal strengths of the various salts and acids show the same degree of toxicity in cultures of rye and barley. When the plant was well developed, the acidity of the solution decreased considerably. Nitric, sulphuric and hydrochloric acids and the respective salts showed the same toxicity; tartaric acid was less toxic and phosphoric acid least of all. Other cultures were made in SHIVE's nutritive solutions R_4 C_5 of various osmotic pressures (0.002 atm.; 0.1; 0.4). With the strongest solutions there was greater growth and consequently greater change in the acidity. By treating rye, barley and maize in SHIVE's solutions with sulphuric acid and sulphate of aluminium and by changing the solution every day so as to have pH constant it was found that at parity of pH, the acid is much more toxic than the salt. In the bottles containing the salts a varying quantity of precipitate was also found. On the other hand in HARTWELL's and PEMBELL's nutri-

(1) See *R.* Aug. 1922, No. 813; Sept. 1922, No. 909 and No. 910. (*Ed.*)

ive solutions, which contain much less phosphate in proportion to the ther elements, sulphate of aluminium showed itself much more toxic to arley than sulphuric acid of similar strength, and slightly more toxic o rye.

As the plant grows these nutritive solutions tend to become more acid.

We may conclude by stating that the toxicity of aluminium salts is ue rather to the aluminium ion than to the hydrogen ion in the case of lants similar to barley, and that this toxicity decreases considerably y adding much phosphate to the nutritive solution. These results con- rm the theories of HARTWELL, PEMBELL and MIYAKA. The toxicity of cid soils is due in a great measure to their content of soluble salts of alu inium. A. de B.

CROPS AND CULTIVATION

134 - **Effects of a dry, warm Year on Wheat Crops grown at Verrières.** — DE VILMORIN, J., in *Comptes rendus de l'Académie d'Agriculture de France*, Vol. VIII, No. 9, pp. 311-312. Paris, March 1, 1922. AGRICULTURAL METEOROLOGY

The meteorological conditions prevailing in 1921 caused a remarkble growth, rarely observed in a normal year, in a large number of southern arieties grown in the climate of the euvirons of Paris.

At Verrières the southern varieties of wheat, under the exceptionally arm temperature, took a place in the classification which is rarely atained by them. The order of classification of wheats at Verrières in 1921 as follows:

Three new crosses, not yet propagated and sown on a large scale:) (Melbor × Grosse tête × J. P. × Alliés) — 2) (Grosse tête × Melbor (Hérisson sans barbes) — 3) (Hâtif Inversable × Alliés); — three outhern varieties: Riéti — Bladette de Besplas — Rouge prolifique barı; — a hybrid under examination: Wilhelmine wheat.

The Blé de la Paix, a new large-yield variety, is classed twelfth; the nversable, thirteenth; and the Gironde, fourteenth.

Wheats belonging to cold regions, such as the Altkirch and Rouffach, lso felt the influence of the season. They are classed 32nd and 36th only

The best yields, obtained on cultures of transplanted wheat were as ollows (in kg. per ha.): Melbor × Grosse tête × J. P. × Alliés, 18 190 — rosse tête × Melbor × Hérisson sans barbes, 17 885 — Hâtif Inversable (Alliés, 17 215 — Riéti 16 600 — Bladette de Besplas, 16 580 — Rouge rolifique barbu, 16 545 — Croisement composé (Mixed Cross), 16 500 — Vilhelmine, 16 430. F. D.

135 - **The Treatment of Soil with Ferrous Sulphate and its Influence on the Soil Solution obtained by the Lipman Pressure Method** — LIPMAN, C. P. (University of California) in *Soil Science*, Vol. XIII, No. 1, pp. 55-56. New Brunswick, N. J., January 1922. SOIL PHYSICS

The author applied ferrous sulphate to the soil of a lemon orchard and ter an interval of several weeks took samples of the soil, from which he tracted the soil solution by the pressure method. On analysis this solu-

tion was found to differ in a marked degree from that obtained from land not treated with ferrous sulphate. The sulphate of iron had increased considerably the content of non-volatile solids in the soil solution and had precipitated dissolved organic matter. The iron had substituted itself for the common bases, calcium and potassium, and had increased the amounts of phosphorus, potassium and calcium in solution. A. de B.

1136 – **Zinc as a normal Constituent of Soil under Cultivation and of Plants.** – MONTANARI, C., in *Le Stazioni sperimentali agrarie italiane*, Vol. LIV, Nos. 7, 8, 9, 10, pp. 278-283, bibl. of 9 works. Modena, 1921.

The presence of zinc in plants was discovered about 50 years ago by RAULIN, but it was only in 1911 that DELEZENNE proved the importance and wide diffusion of this metal in the various animal and plant tissues. The writer, repeating the experiments with the improved DELEZENNE method, examined about 10 soils in the Province of Pavia stretching from the left bank of the Po to the Appenines. Although they differed greatly in their mineralogical character, he found considerable traces of zinc in every one of them, the amount being from 7 to 11 mgm. per kg. of dry soil. Nothing certain is known yet as to the function of zinc in plant life. According to MAZÉ, it is indispensable to the growth of maize, and its absence would cause acute chlorosis.

The writer tested the chlorophyll extract of spinach for zinc, but the result was negative. The matter from which the chlorophyll had been extracted was however rich in zinc, viz., 25.3 mgm. of zinc per 100 gm. of dry matter in spinach leaves. It still has to be decided what plant organs contain the largest quantity. DELEZENNE believes that zinc exercises special catalytic action in connection with the function of chlorophyll and with the circulation and metabolism of complex organic substances. A. de B.

1137 – **Base Exchange and Alkalinity in Egyptian Soils.** — PRESCOTT, J. A., in *The Cairo Scientific Journal*, Vol. X, No. 106-107, pp. 58-64, bibliography of 15 works. Cairo, May 1922.

The presence of sodium carbonate in the soil solution is one of the most frequent causes of infertility in Egyptian soils, although the area affected are not usually extensive.

Sodium carbonate is one of the most difficult of soil constituents to determine; variations of 400 % may be obtained in analysis according to the method adopted. No extract of this substance can be obtained even with 40 % alcohol; the maximum quantities are obtained by a fairly low proportion of soil to water (1 : 20) and extraction at the temperature of boiling water. The only constant value is the hydroxyl ion concentration. Normal Egyptian soils and the original Nile silt are faintly alkaline (pH = 8).

In the author's opinion, the origin of sodium carbonate in Egypt is to be attributed to the reversible reactions between neutral salts, and zeolites and kindred compounds. The Nile alluvium contains more than 2 % of salts (chiefly an alumino-silicate complex, probably colloidal in character)

which can react with neutral salts by base exchange. The soil of Bahtim contains at least 10 % of such salts.

The author carried out a series of experiments which fully confirmed the truth of his theory. Fifty grammes of good Bahtim soil containing no sodium carbonate, only about 0.1 % of bicarbonate, and having a pH of 8.2 were treated with a 10 % solution of sodium chloride, and subsequently washed with alcohol. This treated soil sample gave on analysis 0.344 % sodium carbonate and 0.462 % of bicarbonate ; its pH was 9.3. It had thus become similar to one of the worst cases likely to be found in cultivated land. A. de B.

1138 - **Determination of the organic Matter in the Soil.** — BOUDORFF, K. A., and CHRISTENSEN, R. H., in *Tidsskrift for Planteavl*, Vol. XXVIII, No. 2, pp. 265-275. Copenhagen, 1922.

After having completed the experiments, of which an account has already been published, which were made by. CHRISTENSEN on the power of the soil to decompose mannite, the writers made preliminary investigations on the possibility of determining directly the mannite content of soil extracts. The results showed that the method employed up to the present for determining organic substances in soil extracts is not entirely satisfactory since the oxidation of the greater part of the mannite present does not allow a quantitative analysis. A special experiment made on the subject indicated that such analysis can only be carried out when a large excess of permanganate is present.

In consequence of the results obtained the writers recommend the following modifications.

Place a soil extract containing 0.25 gm. of soil in a glass with 50 cm. of diluted sulphuric acid (6 : 200). Heat for 20 minutes in a dish, add 10 cm. of a normal $^1/_{20}$ solution of oxalic acid and titrate with a normal $^1/_{50}$ solution of permanganate of potash. A. de B.

1139 - **Partial Sterilisation of the Soil.** — RIVIÈRE, G., and PICHARD, G., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. CLXXIV, No. 7, pp. 493-495. Paris, Feb. 13, 1922.

If arsenite of soda be added to a soil a great change takes place in its microbial flora and fauna. If the doses of arsenite of soda are below a certain limit (about 10 gm. per sq. m.), the higher plants do not suffer in any way, whereas the protozoa, which destroy the useful bacteria, die in large numbers.

Both before and after the war, the writers made experiments on 10 ha. of different soils, using various plants and their results are as follows : 100 kg. of arsenite of soda per ha. destroy the protozoa, but have an injurious effect on the higher plants ; a dose of 21 to 42 kg. per ha. (= 2—4 gm. per sq. m.), does not injure them but encourages the growth of useful bacteria and has an indirect influence on yield, which is increased from 20 to 50 %. Owing to the low price of arsenite of soda it can be advantageously used for partially sterilising the soil in order to obtain more

abundant yields, without any temporary necessity for the addition of nitrogen fertilisers. A. de B.

1140 – **Action of Carbonic Acid Liberated by Micro-Organisms in Improving Arable Land.** — STOKLASA (Professor at the Higher Technical School of Agriculture at Prague) in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 8, No. 21, pp. 594-596. Paris, June 7, 1922.

The writer has studied the physiological functions of soil bacteria for 25 years ; he first observed that fertility is in direct ratio with the number of bacteria contained in the soil, whatever be the nature of these bacteria. The best soils are always characterised by the presence of a large number of bacteria and, consequently, by great biological activity.

As this activity is manifested by respiratory changes — the liberation of carbon anhydride and the absorption of oxygen — it can be easily measured. The writer has constructed a special and very practical apparatus for this purpose. He measures the quantity of carbon anhydride liberated from 1 kg. of arable soil. In soils of medium fertility he found that in a layer 36 cm. thick, 1 kg. of soil liberates 30 mg. of carbon anhydride in 24 hours, which, in 5 million kg. of clayey soil, amounts to 150 kg. of carbon anhydride per day, and for 200 days growth in the year, 15 million kg. of carbon anhydride. This gas dissolves in the water contained by the soil and, in circulating, plays an important part in transforming insoluble mineral salts into soluble matter, especially phosphates and in a secondary degree, silicates ; it also acts on the cations, transforming them into carbonates easily absorbed by the roots, which greatly increases the chlorophyll assimilation of the carbon. And as the absorption of the other elements (nitrogen, sulphur, phosphorus, hydrogen, oxygen, potash, calcium, magnesium, iron) is in constant ratio with the assimilation of carbon, it follows that plant nutrition and growth are greatly aided.

The respiration of the micro-organisms also causes a rise in the temperature of the soil which, for a depth of 10 — 30 cm. rises 1 — 2° C, or 4 — 8 million calories per ha., which should greatly influence the growth of the roots of plants.

Good results may be obtained by chemical fertilisers — nitrates, superphosphates, etc., and certain catalytic substances — but for a maximum yield the plants must also be supplied with carbon, in the form of carbonic acid ; there is only one way of doing this, namely, by increasing the biological activity of the bacteria by means of biological fertilisers. L. V.

1141 – **The Influence of Plants upon Oxidation Processes in the Soil.** — NELLER, J. R., (New Jersey Agricultural Experiment Station), in *Soil Science*, Vol. XIII, No. 3, pp. 139-158, Plate 1, bibliography of 66 works. Baltimore, March 1922.

The symbiotic relationship between leguminous plants and bacteria was established only after years of investigation. It is probable also that in the soil relationships of another nature exist between micro-organisms and plants. Certain germs may function more actively in the immediate vicinity of roots and may benefit the plants. The author's studies give

him reason to believe that some such relationship exists between oxidising bacteria and growing roots. The processes of oxidation which take place in the soil under the influence of micro-organisms are made evident by the formation of carbon dioxide. It thus becomes a question of ascertaining whether growing plants have any influence upon the rate of oxidation of soil organic matter.

The author gives a very thorough account of the records of research on this matter which helped to explain soil oxidation, especially those concerning nitrification and the influence of plants on oxidation. It is necessary to recall the work of SCHREINER and SULLIVAN; TURPIN; LAWES, GILBERT and WARINGTON; KING and WHITSON; FRAPS etc. The influence of plants on various nitrifying bacteria was recognised by BERTHELOT; HEINZE; BROWN; that on bacterial flora in general by CARON; STOKLASA and ERNST; LECLAIR.

The investigations are not always in agreement and some even are contradictory, but, as RUSSELL stated, field experiments alone do not enable us to decide this question and the systematic laboratory investigation has still to be made. It was for this reason that the author considered that a review of the problem might be of value.

The carbon dioxide liberated by bacteria in the soil in the presence of plants is not always that which is available for direct estimation. As a matter of fact part of this is absorbed by the roots and used in photosynthesis. It is necessary to keep this in mind, as this carbon dioxide is in addition to that obtained by the leaves from the atmosphere, and there is no way of separating them. The author got over this difficulty by placing the soil and growing plants in enclosures through which air freed from carbon dioxide was drawn. Thus the only source of carbon dioxide within the enclosures was that produced by the soil bacteria, of which part was absorbed by the roots and part utilised in the photosynthetic process in the leaves. The carbon dioxide not taken up was drawn through absorption towers and estimated, and that fixed in the process of photosynthesis was determined by making a total carbon analysis of the plants.

Thus the total amount of carbon dioxide produced by micro-organisms was measured quantitatively. Allowance should be made for the small amount of carbon present in the seeds or young plants used in the experiment. Another sample of soil under identical conditions but without any plants served as a control. The difference between the quantities of carbon dioxide produced in the two experiments must be attributed to the greater or less activity of soil bacteria in the presence or absence of plants.

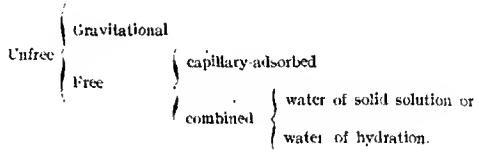
In one of these experiments a soil was used composed of white sand to which was added 10 % of a fertile loam. As compared with the control, soya beans gave an excess of 12.1 % carbon dioxide, wheat 25.2 % and barley 12.9 %. In another experiment an ordinary fertile soil was employed and the difference in carbon dioxide production was even more striking; for soya beans it was 66 %, peas 70.8 % and for buckwheat 116.5 %. The author repeated the experiment, using the same soil again and obtained

in the case of a jar planted with soya beans, an evolution of carbon dioxide 66 % higher than that from unplanted soil.

The experiments thus show that growing plants have a beneficial influence upon oxidation activities in the soil, and suggests a symbiotic relationship between the soil oxidising organisms and the plants. L. V.

1142 - **The Classification of Soil Moisture.** — PARKER, F. W. (University of Wisconsin), in *Soil Science*, Vol. XIII, No. 1, pp. 43-54, Figs. 1, bibliography of 22 publications New Brunswick, N. J. Jan. 1922.

Soil moisture is generally classified under three forms, as hygroscopic, capillary and gravitational water. Recently BOUYOUCOS advanced the hypothesis that a portion of the soil water is inactive or unfree, and does not act as a solvent and suggested a new classification.



The author subjected this theory to experimental tests and found it to be inexact. The lowering of the freezing point is far greater than that indicated by the law of inverse proportions and is due to the presence of solid matter and not to the existence of inactive water. Experiments show that solid matter causes a freezing point depression of water, benzene or nitrobenzene in the film or capillary condition. If one part of the water absorbed by the soil became inactive, a solution added to the soil ought to become more concentrated; but this was not the case when tests were carried out with solutions of alcohol or glycerine. A number of investigators have shown that the water of certain inorganic hydrogels is not combined water. However these hydrogels contain a considerable amount of water which cannot be frozen and a still larger amount which would be regarded as unfree water under the new classification.

Experiments on the rate of evaporation of water from soils, the vapour pressure at different moisture contents, the equilibrium relations with seeds and the freezing-point depression due to solid material do not indicate the presence of different forms of soil water such as are given in the classification of BOUYOUCOS. The results obtained can be explained in the following manner. In the case of soil not fully saturated with moisture, the water is held to the soil particles by the force of adhesion. If the quantity of moisture decreases, the force of adhesion of the remaining water increases, and this causes a lowering of the freezing point, a diminution of the rate of evaporation and a decrease of vapour pressure. This force of adhesion is sufficient to prevent the water from freezing even at a very low temperature.

The water present is subjected to the same law over the whole experi-

mental field and the constant and critical points shown by the soil and varying degrees of water content are equilibrium values only and do not indicate any break in the physical condition of the soil moisture.

The old classification of soil moisture into hygroscopic, capillary and gravitational water is retained, notwithstanding certain objections, and may be regarded as at any rate, very useful. A. de B.

1143 - **Experiments in the Improvement of Alkaline Soils by the Application of Gypsum and other Methods.** — HIBBARD, P. L. (Agricultural Experiment Station, University of California), in *Soil Science* Vol. XIII, No. 2. Baltimore, February 1922. • MANURES AND MANURING

The author describes several methods employed to restore the fertility of the land belonging to the University of California, which was formerly very productive, but now bears next to nothing owing to the large alkaline deposits. From 1914 to 1918, attempts had already been made to improve extensive tracts by means of drains intended to carry off the salts in solution ; the results obtained were however far from encouraging. In 1919, a detailed study of the district was begun and one ton of material from each of the five localities to be studied was examined. It had been intended to treat the soils with gypsum only, but as this did not prove effective, several other methods were adopted. The results obtained were as follows :

By means of simply washing the soil with water, the excess salts could be removed.. A soil which is exceedingly alkaline owing to the presence of sodium silicates, carbonates, or bicarbonates can be improved to a certain degree by the application of gypsum, but fertility is only insured by the immediate leaching action of water which washes the alkalis, and especially the salts, down to the lower layers, thus making it possible for the seeds to germinate in the upper layers which otherwise would have remained toxic.

A rise in the carbon dioxide content of the soil air decreases the alkalinity, and allows plants to grow. This can be obtained without difficulty by introduction of organic substances that decompose readily.

When a soil contains more than 0.5 % of sodium carbonate and other sodium salts, it is difficult to make it fertile by the application of gypsum, because the reaction between gypsum and sodium carbonate is reversible. In order to check the inverse reaction, the sodium salts in solution must be removed by drainage, for owing to the slight solubility of gypsum (about 0.25 %), it is useless to try and affect the direction of the reaction by increasing the proportion of this substance. Before the alkalinity of the soils is reduced by leaching, a flocculating agent such as gypsum or calcium bicarbonate should be added to prevent the formation of impermeable, puddled layers. Water containing sodium carbonate or bicarbonate should never be employed.

When the sodium chloride and sulphide are removed from a soil by leaching, a perceptible rise in its alkalinity, or a fall in its pH value, is often observed. The alkalinity may be sufficiently high to be toxic to plant life, but as a rule, the amount of alkalis present is so small that the

little carbon dioxide liberated by plants or produced by decomposing organic matter, suffices to keep it below the toxic limit.

A. de B.

1144 – **Injurious Action of Composts.** — PETIT, M. A., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. 174, No. 21, pp. 1362-1364. Paris, May 22, 1922.

In this article, the writer describes some experiments made to find out and study the causes why composts are injurious to the growth of certain plants.

It had previously been proved that these composts after washing acquired a higher fertilising power. The writer observed that certain plants, *e. g.*, the *Primula obconica*, derive no benefit from this washing, while others, such as the hybrid cineraria, suffer from it. This is explained by the fact that the washing not only gets rid of injurious substances, but also carries away soluble matter which is easily assimilated. In the experiments made with the hybrid cineraria it was also observed that composts of recent formation, in which the process of denitrification is still active are more injurious than those of older formation.

Certain calcifugous plants, such as the ericaceous group (azaleas, rhododendrons, etc.), suffer from the addition of composts to the soil, even in slight doses. This, as the writer has proved by his experiments, should be attributed not only to the small quantity of carbonate of lime (1-1.21 %) always present in the composts but also partly to the action of injurious soluble substances. Indeed, the wrinkled calceolaria, for instance, becomes chlorotic in soil containing 1.21 % of carbonate of lime, whereas it remains green in one rich in humus and containing 2.56 % of limestone. The writer has also observed that the addition of ferrosulphate to unwashed compost in the proportion of 2 to 3 ‰, neutralises the injurious action (chlorosis) of this compost on certain plants, *e. g.* on the hortensia (*Hydrangea Hortensia*) and the wrinkled calceolaria. The beneficial action of ferrosulphate should be attributed exclusively to the iron ; the addition of other sulphates (sulphate of potash, of aluminium and of manganese) had in fact no effect.

It was also observed that the use of washed compost has a beneficial influence on certain plants (the hortensia and calceolaria) only for a certain period, and that the same thing takes place when washed compost to which iron sulphate has been added, is used. After a certain time the plant begins to become yellow, and, to avoid chlorosis, a fresh dose of ferrosulphate is necessary. The writer comes to the conclusion that injurious soluble substances are continually forming during the decomposition of the compost.

Finally the writer has tried mixtures of compost and sand in varying proportions up to equal parts, without any satisfactory result. He obtained good results, on the other hand, by mixing with clayey soil. Very probably the clay with its very high absorbing power fixes the soluble substances which are injurious to plants.

The writer draws special attention to this last observation made in

the course of his experiments, because it shows the great importance also of the physical composition of the soil which is chosen for the preparation of fertilising mixtures. L. M.

1145 - **The Value of Tetraphosphate as a Fertiliser** (1). — HUDIG, J. and MEIJER C., in *Verslagen van Landbouwkundige Onderzoekingen der Rykslandbouwproefstations*, No. XXV, p. 140-159, 8 figs. Gravenhage, 1921.

The authors describe the circumstances which led to the starting of the tetraphosphate industry, the methods of manufacture and the success or non-success of this war-time fertiliser up to the present day. The fertiliser does not require sulphuric acid in its preparation and any quality of phosphates can be used, even such as are not suitable for the manufacture of superphosphates.

After referring to the reports of MENOZZI and BELLUCI, the authors describe the investigations they have made respecting the value of tetraphosphate. The first experiment was made with oats grown in pure sand, in pots ; these were given, as fertilisers, chloride of potash and agnesium sulphate ; one set of these cultures were given nitrogenou tiliser in the form of nitrate of soda and the other nitrate of ammonium. ie eight pots of each of these two sets received respectively as phosphatic nure : phosphate soluble in water — phosphate only slightly soluble — soluble phosphate — low grade crude phosphate — high grade crude osphate — the same high grade crude phosphate, heated to 700° C d rapidly cooled — tetraphosphate — no phosphate at all. These periments have shown that in a slightly acid medium, tetraphosphate d the two other crude phosphates are of value. The favourable results tained with tetraphosphate on rice plantations may probably be atbuted to the acidity of the soil. The fact that MENOZZI obtained favourable results was probably due to the fact that the soil used his experiments contained a sufficiency of phosphates, or to its alkaline action. The cultures failed when grown in an alkaline medium with ide phosphate.

A second study was made by the authors by carrying out comparve field experiments with 17 % superphosphate, 18 % French, Somme osphate and tetraphosphate containing 26 % of phosphoric acid. These als showed that :

1) in alluvial soils tetraphosphate and Somme phosphate were uivalent, although in sands of the " Anna-Paulownapolder " tetraphosate was superior to French phosphate.

2) in " roodoorngrond " super and tetraphosphate gave an increase 13 % in yield ;

3) in the 22 cultures in sandy soil which responded to tetraphosate, 6 gave a better yield with the tetraphosphate than with Somme osphate ; of these 6 cultures, three gave higher yields with tetraphosphate an when super was used ; in the remaining three cases the two fertilrs proved to be equally effective.

(1) See *R.* 1916, Nos. 35, 1063; 1920, No. 498; 1922, No. 385. (*Ed.*)

These results were obtained with cultures of red clover, lupins, peas and oats. On the other hand with cereals and potatoes, 4 instances were recorded in which tetraphosphate was inferior to crude phosphate.

The authors summarise their work as follows :—

1) In sandy soils which had received a manure with an alkaline reaction tetraphosphate did not give such good results as ground, crude phosphate, and was decidedly inferior to soluble phosphate.

2) In sandy soils to which had been added a manure with an acid reaction, tetraphosphate gave good results ; the best however were those with crude, ground phosphate. The yield with tetraphosphate was the same as that obtained with soluble phosphate.

3) In the cases where tetraphosphate proved superior to superphosphate the result must be attributed to the acidity of the soil, which caused the superphosphate to be ineffective and to certain unknown factors in connection with plant requirements and soil reactions.

F. S.

1146 – **Various Grades of Basic Slag in Great Britain.** — I. *The Journal of the Ministry of Agriculture*, Vol. XXIX, No. 6, pp. 530-533. London, September 1922. — II. ROBERTSON, G. S. (D. Sc., F. I. C.), Field Experiments with Rock Phosphates and Basic Slags, *Ibidem*, pp. 519-530, figs. 5. — III. JURITZ CHAS, F. M. A. (D. Sc., F. I. C. Chief Division of Chemistry), Basic Slag, the Change in its Composition. *Journal of the Department of Agriculture*, Vol. V, No. 1, pp. 76-79. Pretoria, July 1922.

The Permanent Committee appointed in Great Britain by the Ministry of Agriculture to study the question of basic slag presented a report in 1921 and have now presented a second, in which they examine the situation and give an account of the experiments that have been carried out.

The demand for ground basic slag by the farmers of the United Kingdom has increased since the pre-war period (1912) from 290 000 tons to some 400 000 or 500 000 tons (with a phosphate content of 11 000 000 to 12 500 000 units) per annum, and will probably still further increase, as is shown by the following figures.

	Consumption		Deliveries year ending May, 31		Expert estimate of the quantity that could be consumed	
	pre-war (1912)	1919	1920	1921	Sir T. H. MIDDLETON	Sir A. D. HALL
	tons	tons	tons	tons	tons	tons
England and Wales . .	—	433 000	407 000	328 000	890 900	975 000
United Kingdom	290 000	529 000	503 000	400 000	(32 820 000 units.)	(37 050 000 units)

On the other hand, the production of unground basic slag has not increased correspondingly. Prior to the war, it was about 400 000 tons rising in 1919 to 1920 to 701 000 tons, but in 1920-21 falling again to less than 400 000 tons. Moreover, there was a reduction in quality in consequence of the substitution of the acid OPEN HEARTH process for the Bes-

EMER process. The slag now obtainable contains on an average only ıalf the percentage of phosphate present in pre-war days, and much of t shows reduced solubility according to official tests.

The demands of the farmer have been met to some extent by import-ıtion from abroad. Thus, while in 1913 the balance of exports over ıports was 114 000 tons, in 1920 and 1921 it was respectively 6000 and 8 000 tons. Export was however in these years prohibited except by li-ence. In view of the probability that the quality of the basic slag manu-ıctured on the continent may deteriorate as it has in the United King-lom, by the gradual substitution of the OPEN HEARTH for the BESSEMER process, it would be unwise for British farmers to rely to any serious extent on importation.

Further, after careful investigation, it appears that little if any change actual engineering processes is likely to improve either the output or ıality of slag. From the point of view of steel manufacture basic slag relatively unimportant; on the average rather less than 4 cwt. are obtain-l per ton of basic steel produced, and while a ton of steel has been worth om £27 in 1920 to £10 in 1921, the 4 cwt. of slag are not worth more ıan 2s. to the steel-manufacturer and only about 6s. on the market. he steel-maker therefore cannot afford to lengthen his processes or make ıem more costly or hazardous.

The quality of basic slag is determined by the process employed, and ıe total amount producible is regulated by the demand for steel; neither f these factors can be influenced to any appreciable extent by the require-ıents of the farmer.

The Committee have examined the possibility of substituting ground ıineral phosphates for basic slag and of increasing their effectiveness. ne of the slags tested in the field in 1921 gave considerably better results ıan could have been expected from its chemical composition. Other xperiments in the same direction are now in progress. A typical North frical mineral phosphate is included in the Rothamsted trials, and the xperiments carried out in various countries are being repeated at the tothamsted Station.

Owing to the exceptionally severe drought in 1921, very few results ere obtained in any of the field trials, but in any case the trials must ex-nd over several seasons before definite conclusions can be reached.

So far as present information goes, it may be stated that: *a*) The ghly soluble OPEN HEARTH basic slags have the same agricultural value r unit of phosphoric acid as the old BESSEMER slags.

b) The slags of low solubility have a lower value, but in some cir-ımstances the difference is not very marked. There is however consider-ble difference in the effectiveness of this group which is probably due to e fact that it is composed of materials of very different nature, although e citric solubility test fails to distinguish satisfactorily between them.

c) The mineral phosphates also have a lower value, but in some ses, they are worth more than might have been expected.

As a result of these trials, the Committee hope to be ultimately able to:

1) Map out the country into regions where the high soluble slag can and cannot be replaced effectively by low soluble slags and mineral phosphates.

2) Advise the Ministry whether the annual output of very low grade slag (under 15 % phosphate) which amounts to some 70 000 to 140 000 tons, could not be used with advantage after being mixed with mineral phosphates.

The Committee are further of opinion that the official solubility test needs revision.

II. — The author examines the various kinds of basic slag, and the phosphates that could be used to replace them, and describes the experiments made in this direction.

The basic slags now obtainable may be divided into three types: -

1) *High Grade,* containing from 33-42 % of phosphate. Part of this supply consists of the rapidly diminishing remnants of the Basic Bessemer Slag, and this class will probably completely disappear.

2) *Open Hearth Basic Slag* containing from 15 to 32 % of phosphate.

3) *Open Hearth Fluorspar Slag* containing from 15 to 32 % of phosphate.

Types 1 and 2 have a citric solubility of 80-95 % and are of equal value per unit of phosphate. Type 3 has a citric solubility of 6-50 % and it is this type of slag that is of uncertain value, for it cannot be distinguished by appearance. How much of the present supply belongs to this type it is impossible to say, but the proportion is likely to increase in the future.

One of the possible substitutes for the old type of basic slag is ground mineral phosphate. The various rock phosphates are not identical in character — they differ in their phosphate content, which is usually high, in chemical composition, and citric acid solubility which is intermediate between that of types 1 and 2 and of type 3. Experts however differ as to the extent to which citric solubility may be taken as a measure of the relative value of the various phosphates. The following table gives the principal rock phosphates with their characters :

Name of Phosphate	Origin	Approximate Phosphate content	Citric Solubility
		%	%
Gafsa	North Africa	56-64	38
Egyptian	» »	56-60	35
Algerian	» »	58-66	33
Florida Soft	United States	48-54	27
Tunisian	North Africa	54-60	24
Tennessee	United States	30-60	23
Nauru	Oceania	82-88	21
Makatea	Oceania	82-86	19
Florida Pebble	United States	70-76	18

Several experiments were made in Essex from 1915 to 1919. Three types of basic slag were used and several rock phosphates and superphosphates. Meadow land poor in phosphoric acid was selected for the trials, and eight experimental centres were laid down, the following soil formations being represented : London Clay, Boulder Clay and Chalk. Other experiments were carried out in North Ireland on different types of arable land land.

CONCLUSIONS FROM THE FIELD EXPERIMENTS.

1) Open Hearth Fluorspar basic slags are not as effective as the oluble types. They have however a considerable value and are more ffective than the solubility figures would suggest. Where the rainfall is igh and the soil sour, they are nearly as good as the more soluble types, ut where the conditions are reversed, their inferiority is more clearly arked. For the manuring of grassland the author is of opinion that if he value of the highly soluble slags is taken as 100, the fluorspar basic lags have a value of 50-70.

2) The results of all the experiments agree in showing that rock hosphates have a higher manurial value than has hitherto been supposed. n sour soils and when the rainfall is high, they may even prove superior o the best grades of basic slag. In all cases, they have proved more effecive than the fluorspar slags. Of the various types of rock phosphates afsa seems the most suitable for direct application. On sweet soil or here the rainfall is low the more soluble types of North African phosphates Gafsa, Egyptian, Algerian and Tunisian) are superior to the richer, but less oluble and harder types, such as Florida Peble.

III. — The author gives a short account of the work and findings f the Committee. He examines the possibilities of improving the lowest rades of slag by their reintroduction into the blast furnace, and exludes the idea that other constituents such as manganese can have any alue in improving the quality of basic slags. He quotes the opinion of r. E. J. RUSSELL, the President of the Committee, who stated on the ubject of basic slags that though types with high solubility come into ction more quickly and produce a larger return the first season, the low oluble slags may increase in effectiveness, so that after 5 years there may e little difference between the two.

A. de B.

1147 - **Potassic Deposits in Poland.** — *Les Mercuriales Agricoles*, Vol. VI (Second series), No. 18, p. 138. Antwerp, May 5, 1922.

Potassic salts have hitherto been worked in Poland only in the neighbourhood of Kalusz in Galicia, but there is reason to believe that potassic deposits exist in other regions of Galicia and notably in the vicinity of le Bochnia and Wieliczka.

Prof. MICHAELIS is of opinion that beds of potassic salts are also to e found in Posen ; these would form the extension of corresponding eposits in Germany.

The output at Kalusz used to be extremely small, the total extraction (in tons) being only.

1913	1919	1920	1911 (6 months)
2 344	2 500	10 293	6 737

The amount extracted in 1921 was at least six times larger than the pre-war out-put, but it will only satisfy a small fraction of the requirements of Poland, which country must for the present remain dependent upon foreign sources for its supply of potassium. A. de B.

1148 – **Pot Culture Tests on the Availability of Potassium in Greensand Composts.** – SMITH, A. M. Agricultural Experiment Station, College Park, Maryland), in *Journal of the Association of Official Agricultural Chemists*, Vol. V, No. 1, pp. 133-136. Washington, D. C., August 1921 (1).

The author describes experiments made by himself with a view to ascertaining the possibility of the use of glauconite as a fertiliser. This mineral, which is commonly known as greensand, consists chiefly of the hydrous silicate of iron, aluminium and potassium. It forms extensive deposits in New Jersey, Maryland and Virginia; the present investigations have therefore great practical importance for these States. Greensand can be applied to soil either composted or uncomposted. Previous work at the Maryland Agricultural Experiment Station (2) had shown that composting greensand with sulphur and organic matter changed a considerable part of the insoluble potassium into a water soluble form.

The author carried out his experiments with barley in glazed pots, each pot held 2800 gm. of sandy loam containing only 0.82 % potassium. To the control pots ammonium sulphate and monocalcic phosphate only were added. The other pots received an equal amount of potassium, in the form of sulphate and pure unmixed greensand, or else a mixture of greensand, sulphur and manure, or greensand compost containing organic matter and sulphur.

Some experiments were made at the same time in the absence or presence of calcium carbonate. Each treatment was in duplicate.

The results obtained show that under favourable conditions, on a soil low in potassium, an application of greensand alone increases the yield of barley. On the same soil, in the absence of calcium carbonate the addition of the mixture greensand + sulphur + manure, and the application of compost greatly injured the crops, whereas in the presence of calcium carbonate excellent results were given.

The author also found that when the compost was applied, large quantities of free acids were liberated in the soil; observations made to determine the water soluble acidity of the compost also indicated the presence of large amounts of soluble iron and aluminium salts. It is to these salts that the author attributes the reduction in yield, produced by the mixture and

(1) See *R.* March 1921, No. 257. (*Ed.*)

(2) *Journ. Assoc. of Offic. Agr. Chemists*, IV, 375, 1921. (*Ed.*)

compost when there is not sufficient lime to convert them into a form that is not injurious to plant life. This is in agreement with the work of other investigators.

To sum up : the author has proved by his experiments that the potassium contained in a greensand-sulphur-manure compost (in the presence of sufficient lime) has practically the same availability as an equivalent amount supplied in the form of potassium sulphate. L. M.

1149 - **The Nitrogen Industry in Germany.** — I. MURAOUR, H. (Chef de service des experts chimistes à la Commission militaire interalliée de Contrôle en Allemagne), L'azote en Allemagne avant, pendant et après la Guerre, in *Chimie et Industrie*, Vol. VIII, No. 1, pp. 169-175, figs. 5. Paris, July 1922. — II. MATIGNON, C., L'Industrie des matières azotées en Allemagne, *ibidem*, pp. 176-184 (1).

I. — The total amount of nitrogenous substances used in Germany before the War was over 240 000 tons ; of these, 200 000 tons were employed for agricultural purposes, which (taking the cultivated area as 35 million hectares), means at the rate of 6 kg. of nitrogen per hectare. This includes only mineral nitrogen, not the nitrogen supplied by organic fertilisers.

As regards nitrates, Germany was entirely dependent on importation before the War. She imported annually from Chile 800 000 tons of salpetre containing on an average 15 % of nitrogen, that is to say, 120 000 tons of nitrogen, while she obtained from Norway 2 400 to 10 000 tons of synthetic nitrate. On the other hand, the gas industry annually produced 550 000 tons of ammonium sulphate which is equivalent to 110 000 tons of nitrogen. The cyanamide output is difficult to estimate ; it appears that the maximum production was 40 000 tons with 8 000 tons of nitrogen. Finally, by the HABER-BOSCH process, 2 017 tons of synthetic ammonia were made, which represents 1661 tons of nitrogen.

The total nitrogen consumption during the War has been reckoned at 40 000 tons, of which 514 000 tons were applied to military uses, and 26 000 tons employed for agricultural purposes. Thus less than 50 % was used for agriculture than in times of peace, and the crops were considerably reduced. When the war began, Germany possessed the following nitrogen reserves : 6 000 tons under the form of Chile saltpetre, 10 000 tons under the form of Norwegian saltpetre and of cyanamide, and 10 000 tons under the form of ammonium sulphate. In March 1915, these reserves were exhausted but 5 000 tons, taken chiefly from Antwerp, supplied the explosives factories until May 15, the date when the great factories of synthetic nitric acid belonging to the B. A. S. F. at Oppau and Merserburg were in full work.

During the War, Germany imported 8000 tons of nitrogen from Norway ; the coke and gas industries supplied 400 000 tons, whereas in pre-War times, their annual output was only 60 000 tons ; the cyanamide factories produced 168 071 tons, and the synthetic ammonium factories 240 436 tons. At first, the factories of synthetic ammonia were only able to supply very dilute acid which had to be converted into nitrate before a concen-

(1) See *R.* Oct. 1922, No. 1028. (*Ed.*)

trated acid could be obtained. From these nitrates and the nitrate reserves 182 200 tons of nitrogen were obtained under the form of nitric acid. Subsequently, by directly concentrating the dilute nitric-acid, 35 860 tons of nitrogen were obtained.

Since the War, owing to the fall of the mark, Germany has tried to dispense with imported food stuffs and forages, which before the War had reached the value of 3 million marks, trusting to intensive agricultural production to provide the necessary supply. By the Treaty of Versailles, she lost 5 million hectares of arable land, but the reclaiming of new land will soon bring up the cultivated area to the pre-War figure, viz. 35 million hectares. The nitrogen consumption has already exceeded the 200 000 tons used annually during the period preceding the War, and will soon rise to 500 000 tons. The demand now exceeds the supply which has decreased owing to the Oppau disaster and the shutting down of the Khapsack and Walshut factories. A vigorous and successful campaign has been started to induce farmers to use more nitrogenous fertilisers.

As a result of all these changes, the amount of Chile nitrate imported at present is almost negligible, hardly reaching 31 000 tons. The gas and coke industries now suply 110 000 tons of nitrogen as they did before the War; the cyanamide factories could furnish 500 000 tons, representing 100 000 tons of nitrogeu. The nitrogen output of the B. A. S. F. will be 300 000 tons, which at 30 marks the kg., represents the value of 9 thousand million marks. The amount of nitric acid made by the electric-arc process is the same as before the War, viz., 1272 tons annually.

Factories making nitric acid by ammonium synthesis can produce 111 456 tons of nitrogen, while the nitrogen output of those which obtain it by the concentration of the dilute acid may be 1338 tons.

Before the War, Chile was the country that produced most nitrogen, 392 000 tons ; Germany followed with 122 000 tons, after which came England, 88 000 tons ; the United States 35 000 tons ; France, 16 500 tons ; Austria-Hungary 10 500 tons ; Belgium 9 800 tons, and Norway 9 600 tons.

At the present time, Germany ranks first with 500 000 tons of nitrogen, which is nearly the total pre-War output of the seven great nitrogen-producing countries. This must not however be regarded as her maximum production, for schemes are under consideration for the construction of other large factories for the manufacture of cyanamide at Pisteritz, and the utilisation of the waterfalls in Bavaria.

II. — Even before the War, Germany was the country that consumed the greatest amount of nitrogen, 218 250 tons. Next followed the United States, 146 000 tons ; France 68 000 tons ; England 43 000 tons, and Belgium 35 000 tons.

During the last 20 years, Germany has succeeded in increasing by 60 % the returns from her land which although inferior to that of France is much more highly productive. Germany uses for every hectare of land fit for cultivation 8 kg. of nitrogen, France uses 3, England 6.25 and Belgium 17.04.

In the German agricultural programme it is estimated that the annual

consumption of nitrogen this year will reach 500 000 tons. Over a thousand million marks have been expended by Germany in building new factories, but without them in 1921 alone she would have been obliged to import 230 000 tons of nitrate from Chile, which means an outlay of 400 million gold-marks, or 27 thousand millions of paper-marks.

The seven societies engaged in the development of the HABER-BOSCH process, which form the Chemical Industry Consortium, possess a total capital of 1762 millions, to which must be added compulsory obligations amounting to 153 millions. Before the end of 1922, their annual output will be 300 000 tons of nitrogen.

In addition to the old fertilisers, the " Badische " has put on the market several new compounds: ammonium hydrochlorate, ammonium nitro-sulphate, ammonium potassic nitrate.

Germany is not satisfied with having been freed from the necessity of importing nitrate but also intends soon to export it, and to enter into competition with Chile on all the markets. Further, she has acquired the means of producing in future hitherto undreamt of quantities of explosives, an amount eight times larger than France could ever manufacture.

A. de B.

50 - **The Transformation of Ammonia into Urea.** — MATIGNON, C., and FRÉSACQUES M., in *Comptes rendus hebdomadaires des séances de l'Académie des Sciences*, Vol. XIV, No. 7 pp. 435-457. Paris, February 1922.

The authors give a report of their studies on the transformation of nmonium carbonate into urea, a process by which in 4 hours 1 % of amonia was obtained at 130° C, 6 % at 135° C, and 41 % at 145° C. As the action is a dehydration process, an attempt to accelerate it was made by ıe use of catalysts that proved most effective at low temperatures, but ere useless at 150° C. The urea thus obtained is very pure and melts at 13° C. It can be separated from the carbonate and other salts present by /aporation in a water-bath; the operation is quantitative.

The results of the authors' studies have enabled them to devise a sysmatic method for the industrial manufacture of urea, a highly concentrat-l nitrogenous fertiliser. A de B.

151 - **The Decomposition of Ammonium Nitrate by Heat.** — SAUNDERS, H. L., in *Journal of the Chemical Society*, Vols. CXXI and CXXII, No. 714, pp. 698-711. London, April 1922.

This experiment was undertaken with the object of obtaining further formation regarding the manner in which ammonium nitrate decomposes hen heated. The three points the author proposed to elucidate were: he nature of the decomposition of pure ammonium nitrate at moderate mperatures — the modifications in this decomposition in the presence f small qnantities of the impurities commonly occurring in commercial itrogen — the nature of the explosive decomposition.

The first part of these experiments was directed to the decomposition specially purified ammonium nitrate dried at 100° C.

A very ingenious apparatus was used by the author which enabled him

to follow accurately the decomposition of ammonium nitrate at different temperatures and to collect the gaseous and liquid products of the process. He found that pure dry ammonium nitrate decomposes only slowly at 200° C. The nitrate first melts at 169° C, then separates into nitric acid and ammonia; it then begins to evolve a gas containing 98 % of nitrous oxide. Free nitrogen, nitrogen peroxide, and nitric oxide are always present. The amount of free nitrogen is nearly 2 % up to 260° C and considerably more at higher temperatures. The average amount of nitrogen peroxide and nitric oxide between 220° C and 260° C was 0.001 % of each.

The liquid products of the reaction contained nitric and nitrous acids.

In another series of experiments, the author studied the influence exercised upon the decomposition of commercial ammonium nitrate, heated to a moderate temperature, by the impurities usually present in this nitrate. The commonest of these impurities are the chlorides of ammonium and sodium, the sulphates of ammonium and sodium nitrate.

In order to study the modifying influences of these substances, pure nitrate and mixtures of each of the salts (specially purified by recrystallisation) were made. Various proportions of these salts were introduced, but the amount never exceeded the percentage found in the commercial product.

In the first place, a series of mixtures were made containing quantities of ammonium or sodium chloride ranging from 0.1 to 2 %. It is difficult to state definitely the temperature at which decomposition takes place; the process is always accompanied at the beginning with a remarkable rise in the temperature. When any mixture is raised to a particular temperature, there is first a passive period varying in length from a few minutes to one hour and a half. How long it lasts depends upon the amount of impurities present, on the temperature, and possibly on the presence of free nitric acid (VELEY, *Chemical News*, 1883, XII, 299). Then a new reaction sets in, and chlorine is evolved and is always present in the gas formed. The composition of the gas produced at the beginning of the decomposition of mixtures of nitrate and chlorides is very different from that of the gas evolved in the normal decomposition of pure ammonium nitrate, for in some cases, the nitrous oxide falls 50 %, while the percentage of nitrogen increases. During the first decomposition period, there is a rise in the temperature of the mixture (200-800 C), till it has attained a maximum, after which it again falls. The composition of the gas remains constant during the first period for any particular mixture, but as soon as the temperature begins to fall (most of the chloride having decomposed) it gradually approximates to that of the gas evolved at the same temperature during the decomposition of pure nitrate.

Nitric acid is always present, as well as hydrochloric acid, in the water condensed during the decomposition. The action of the chlorides of ammonium and sodium is very similar, but that of ammonium chloride is more marked.

Ammonium sulphate added to the nitrate in the proportions of 1 and 2 % does not produce any special modifications in the decomposition pro-

cess. The gas evolved sometimes however contains a trace of ammonia. A 1 % mixture of sodium sulphate does not influence the decomposition reaction between 220° C and 250° C.

Mixtures with 1 and 2 % of sodium nitrate are without characteristic action.

In a third series of experiments, the author studied the explosive decomposition of ammonium nitrate. A suitable apparatus was selected and tested for the maintenance of a vacuum. The decomposition products were carefully collected and analysed.

It was found that the decomposition by explosion of ammonium nitrate — even at the lowest temperature at which an explosion will occur — is very different from normal decomposition. The amount of nitrous oxide is greatly diminished, and the gas contains nitrogen peroxide, nitric oxide and nitrogen in the approximate ratio 2 : 4 : 5.

The explosion is accompanied by a yellow flame not unlike that of ammonia burning in oxygen.

The results of the author's three sets of experiments may be summarised as follows : pure ammonium nitrate decomposes into nitrous oxide and water to the extent of 98 % between 210° C and 260° C. At some point near 300° C other oxides of nitrogen are evolved, the action proceeding explosively. At the moment of the explosion, the pure nitrate decomposes in a totally different manner, giving nitrogen peroxide, nitric oxide and nitrogen in the ratio 2 : 4 : 5.

Among the products of normal decomposition, nitrogen is always present, in the proportion of about 2 % up to 260° C ; immediately after explosion, the percentage of nitrogen is 46.

As regards the ordinary impurities occurring in ammonium nitrate, the experiments showed that small quantities of sodium sulphate and sodium nitrate do not influence normal decomposition.

On the other hand, small quantities of the chlorides have a remarkable effect. Their action is of a catalytic character and the decomposition process is modified by even 0.01 % of chloride of sodium, or of ammonium.

In the presence of chlorides, there is always chlorine in the gases evolved, the amount depending on the quantity of the chloride and on the temperature. There may be from 30 to 50 % of nitrogen in these gases.

The liquid products of the reaction always contain hydrochloric acid as well as nitric acid. L. M.

152 - **Borax (1) in Fertilisers and its Effect on Potato Growth and Yield.** — BROWN, B.E. (Biochemist, Office of Soil-Fertility Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in *U. S. Department of Agriculture, Bulletin* No. 998, figs. 10, bibliography of 9 works. Washington, D. C., July 1922.

Injury to field crops through the use of fertilisers containing borax was first observed by CONNER, in Indiana, in 1917. Many serious cases of borax injury were reported in 1919, when ample proof of the poisonous

(1) See *R.* Jan. 1919, No. 25. (*Ed.*)

action of this compound was given. In 1920, a series of well-controlled field tests were conducted on four different types of soil bearing crops of potatoes, maize, peas and cotton respectively.

The author gives an account of the results obtained in Maine on loam; the borax was applied at the rate of 1 to 400 pounds per acre and there were 12 experiment plots. The fertilisers containing borax were applied differently in the three sections: in section 1, they were applied in the furrow 6 days before planting; in section 2, they were applied in the furrow at the time of planting; in section 3, they were sown broadcast and well raked into the soil before planting.

After one month, the number of plants in the control plots was 343; these plots had received 1 ton fertiliser per acre but no borax. The plot that had received 10 lb. of borax per acre had 284 plants. The 20 lb. application showed 205 plants; the 50 lb. application 116; the 100 lb. application 38; the 200 lb. 18 and the 400 lb. application only 12 plants. At the end of the second month, the author inspected the sections and found great differences in them. The section which had been treated in the usual manner by applying the fertiliser in the furrow immediately before planting was the most seriously affected, while that in which the fertiliser-borax mixture was introduced into the furrow some time before planting had suffered least. As the quantity of borax increased the toxic effects progressively increased also. In section 2 the injury was apparently produced with 3 or 4 lb. per acre and certainly with 5 lb.; the injury with 10 lb., or more, was very noticeable. During the investigational survey in Maine in 1919, the amount of anhydrous borax found in commercial fertilisers ranged from 0.73 to 2.3 %. In view of the fact that 2000 lb. represents the usual quantity of fertiliser applied per acre, it is clear that the amount of borax applied varied from 14.6 to 46 lb. per acre. The type of field injury shown in 1910 was similar to that found in the 20, 30 and 50 lb. applications in the borax experiment.

Some of the injurious effects noted in both seasons were as follows: failure of seed to germinate, dying back of underground shoots, bleaching of foliage, or in less serious cases, marginal yellowing of leaflets, reduction in yield. Yield when 50 lb. of borax were applied per acre, was decreased 55 % in the second section and 40 % in the first and third sections.

A. de B.

1153 - **Chili's Sulphur Supply.** — HOFFICER, H. G. in *Engineering and Mining Journal Press*, Vol. CXIII, No. 23, pp. 995-1000, figs. 8. New York, June 1, 1922.

The sulphur deposits of Chili (1) are little known, as the working of these vast beds has been hindered by their altitude and the lack of proper transport facilities. Under good management these mines on the Pacific Coast could compete with the sulphur mines of Texas, as they are of great value owing to the great extent of the beds.

(1) See *R. Mar.* 1920, No. 303. (*Ed.*)

The statistics of the sulphur industry are as follows:

Year	Production	Exports	Imports	Consumption
	t.	t.	t.	t.
1909.	4 507	193	none	4 700
1910.	3 822	1 400	»	5 224
1911.	4 457	4 013	»	8 464
1912.	4 431	4 451	»	8 552
1913.	6 647	1 961	»	8 608
1914.	10 008	526	»	10 534
1915.	9 769	711	»	10 450
1916.	14 879	1 080	»	15 959
1917.	15 942	47	2 555	15 431
1918.	19 557	none	6 406	13 151

The exportation statistics are given below:

Country	1917		1918	
	t.	value in dollars	t.	value in dollars
Argentina	1 976	106 720	3 025	241 500
Bolivia	41	2 224	51	3 670
Brazil	1 227	66 276	2 573	157 300
Uruguay	248	13 371	260	23 000
Totals . . .	3 492	288 591	6 211	425 470

The sulphur deposits are all of volcanic origin and are situated at an altitude of 4000 to 6000 metres; the beds are often 7 to 10 m. in thickness, 25 % of which is sulphur. The working and refining methods are still very primitive and the climatic conditions render working extremely difficult.

The reserves of the sulphur mines are estimated approximately at 1 530 000 t. with an average sulphur content of 60 %. After the gradual, but inevitable exhaustion of the sulphur deposits of Sicily and Japan, there will be only two large sources of this mineral, so far as is known at present, these being the sulphur mines of Mexico and of the Chilian Andes. The exploitation on a large scale of these mines is merely a matter of time.

A. de B.

1154 - **Accidental Flora imported in Wool and the Question of its Acclimatization in Germany** (1). — SCHENCKENAUM, R., in *Mitteilungen der deutschen Landwirtschafts-Gesellschaft*, Year XXXVII, No. 38, pp. 572-573. Berlin, Sept. 23, 1922.

The accidental flora of Döhren (near Hanover), where there is a large establishment for washing wool, has been several times the object of re-

(1) Two papers on this subject have been published by the *Hannoversche Land und Forstwirtschaftliche Zeitung*, the first (No. 1, p. 16, Jan. 6, 1922) by the writer, written on the invitation, addressed to him, as a specialist in adventitious plants of the Hanover Chamber of Agriculture; the second (No. 18, p. 282, May 6, 1922) by M. L. WITTMACK. (*Author's note*).

search and study since 1889. It has been ascertained that the accidental species, which have certainly been introduced in foreign wool, number several hundreds, and every year fresh kinds are observed. The question arises as to which of these species are really acclimatized in the country it may be said that none have been able to survive for long. Thus, according to Prof. ASCHERSON, *Xanthium spinosum*, a native of South America and now spread all over America, in the Mediterranean countries, Central Europe, Western Asia, South Africa and Australia, have been considered as acclimatized at Döhren ; but the writer has pointed out the contrary. During the war the importation of foreign wool was suspended and *Xanthium* disappeared almost completely, to reappear when importation was renewed. It is beyond all doubt that the climate of their new home does not suit these plants and that the insects for cross-fertilizing them are not found there. A few fructify well but do not produce seed capable of germinating. That in spite of this certain species such as *X. spinosum*, *Medicago arabica* and *M. hispida* Gaertn. (= *M. denticulata* Willd.) appear every year in very large quantities must be attributed to the importation in the wool of fresh seed capable of germinating.

Some species of *Medicago* have been observed at Döhren since 1889 : — *M. hispida* with the varieties *macracantha*, *confinis* and *apiculata* ; *M. arabica*, *M. laciniata* from southern countries in the Mediterranean basin ; *M. ciliaris*, native of Mediterranean countries, and *M. minima*.

HEINTZE (*Hann. Land und Forstw. Zeitung*, No. 9, March 3, 1922) has drawn attention to the fact that fruits of *M. denticulata* and of *M. arabica* were found, in 1921, in the wool of several German flocks. But the writer is in agreement with M. WITTMACK on the subject and does not think that there is any fear that these species will be propagated in Germany ; the same is true for the varieties of *M. hispida*, for *M. laciniata* and *M. ciliaris*. Regarding *M. minima*, the writer was doubtful in 1912 whether it was able to acclimatize itself, and in fact it has not done so up to the present : it grows only in places which it reaches with the refuse from wool washing, along the railway lines or in the fields where this refuse is used as manure. German breeders have nothing to fear from *M. minima*.

The seeds separated from the wool by washing cannot be successfully sown ; their germinative power is very limited ; if sheep were sent to graze in pastures sown with these seeds the fruits would attach themselves to the wool and would decrease its value. The writer thinks that the few seeds of Medicago found by the wool washing establishment at Döhren in German wool are seeds of exotic species mixed with seeds of inferior quality.

F. D.

1155 – **Study on the Pollen of Fruit Trees.** — CASELLA, D. (Cattedra di Arboricoltura della R. Scuola Sup. di Agricoltura in Portici), pp. 24, 4 pl., bibliography of 46 publications. Cosenza, 1922.

In fruit trees imperfect setting of the flowers is due to numerous causes. The writer has undertaken its study, selecting among anemophilous trees the vine and the mulberry and among entomophilous trees the Rosaceæ such as the apple, pear, peach, apricot, almond and plum.

The writer refers to and confirms certain opinions already maintained
ıd adds some personal observations. Firstly he examines the influence
: meteorological conditions. A light wind helps pollinization because it
asports the pollen of anemophilous plants without scattering. Moreover,
y favouring evaporation, it accelerates dehiscence; finally by shaking
ıe flowers it facilitates the opening of the anther. On the other hand a
rong wind scatters the pollen and blows away the insects which assist in
ollinization; it may also break off the flowers and break the branches.
ail has a similar injurious effect. Rain washes away the pollen and makes
burst and germinate prematurely in the anthers; it causes browning and
ecrosis of the stigma; makes transport of the pollen by wind impossible;
ashes away the sugary excretions which attract insects, keeps the insects
way and prevents them from feeding on the flowers. In the vine during
in, the hood adheres to the stigma and obstructs the anther; in the Ro-
ceæ the stamens adhere to the style; if the stamens are longer than the
yle, the stigma remains immersed in the water and comes off; if, later,
ıe water evaporates, the stamens regain their normal position and the
ıthers dehisce, but meanwhile the germinative power of the grains of
ollen which have burst or germinated has diminished. Mist is just as
jurious as rain; its moisture causes partial bursting and premature
ermination of the pollen and necrosis of the stigma; pollinization is specially
ndered by a thick mist, which deposits a film of water and sometimes
nall drops. Light and solar heat accelerate all vital functions and con-
quently pollinization; moreover they have an indirect action inasmuch
; they cause the secretion of nectar and the production of colours and
ents which attract insects; they also stimulate the insects themselves.
high temperature accelerates the germination, the bursting of the pollen
ains and the elongation of the pollen tubes. On the other band, low tem-
eratures retard the dehiscence of the anthers, hinder the germination of
ıe pollen and prolong the duration of the elongation of the pollen tube.

The writer has made numerous observations on pollen and ascertained
ıat not only does the pollen vary in different species but also in certain
ıses in different varieties and that, in certain varieties of fruit trees, the
ollen from the same anther has various forms and dimensions and a
ifferent percentage of grains which contain no protoplasmic substance.

The writer undertook numerous tests on the germination of pollen.
/ith this object he tried to use little drops of liquid taken from the stigma
f the almond and difficult to collect, as well as the juice of the plum, pure
ater, moist air, etc. He found that the best was a solution of saccharose
ı the proportion of 10 % (apple), 15 % (pear), 20 % (almond). He often
ound abnormal teratologic forms of which he gives a description. The
ollen grains of the vine always emit a bubble which persists at the inser-
on of the pollen tube and keeps it inflated.

The writer has studied germinative power in various conditions. It
emained constant for each variety of fruit tree. Pollen from diseased
lants was relatively more sterile. The influence of temperature was great-
: the optimum temperature was 15° C for the almond, 20° C for the vine.

Fungicidal and insecticidal preparations were almost all decidedly injurious. The writer also tested the effect of these preparations on the setting of vine-flowers: he painted them on the stigmas with a brush. All the preparations were injurious. Sulphur, to which some persons attribute a beneficial action on setting, was also injurious, and it is probable that the beneficial action attributed to the sulphur is due to the dissemination of the pollen helped by the movement of the air and of the cluster at the time of applying the sulphur. Water proved injurious; it intensified the harmful effects of the fungicides and insecticides on the germinative power. The use of such substances should be regulated so as to obtain the advantages which are desired from them, without injury to production. L. V.

1156 – **Characteristic Proteins in Maize.** — SHOWALTER, M. F., and CARR, R. H. (Division of Agricultura Chemistry of Purdue University) in *The Journal of the American Chemical Society*, Vol. XLIV, No. 9, pp. 2019-2023. Easton, Pa., Sept. 1922.

The writer gives an account of some experiments undertaken on the subject of the content in various proteins and in mono—and diamino-acids of maize. Comparing the species of maize with a high nitrogen content with those with a low content, they found, in the former, a much greater quantity of proteins, in the form of zein and globulin, which were formed at the expense of the amides, as well as albumen and glutein. Most of the globulin is found in the embryo which, in species with high nitrogen content, forms 15 % of the grain, and in "horse tooth" maize 11 %. Zein is the protein which varies most in quantity, from 50.28 % in the former to 31.85 % in the other species. The protein of maize roasted over the fire for food (pop-corn) contains 57.24 %. Apparently the total nitrogen content determines the proportion of the different proteins.

The diamino-acids, in the species with high nitrogen content, show a percentage of total nitrogen double that of the other species. A. de B.

1157 – **The Part played by Respiration in the Decrease of Carbo-hydrates in Leaves during the Autumn Colour Change.** — COMBES, R., and KOHLER, D., in *Comptes rendus des séances de l'Académie des Sciences*, Vol. 175, No. 9, pp. 406-409. Paris, Aug. 28 1922.

SACHS holds the view that while leaves are turning yellow in autumn numerous useful substances migrate to the permanent organs of the plant. Hence at the time of their fall leaves are reduced to a skeleton of worthless matter. WEHNER showed the weakness of this hypothesis and pointed out that the centesimal decrease of some substances contained in the leaves could be attributed to washing by rain. TUCKER and TOLLENS recognised that this actually took place for mineral matter, and MICHEL-DURAND found the same to be the case for hydrocarbonates.

The hydrocarbonate content may also decrease under the action of respiration, which continues in the leaves until the death of the tissues, while the chlorophyllian function disappears gradually and consequently is no longer able to make good the losses.

The writers have proved that this supposition is justified by practical experiments on the leaves of *Fagus sylvatica* and *Aesculus Hippocastanum*

ucked when they began to turn yellow, and on the leaves of *Ampelopsis deracea* when beginning to turn red.

The leaves were placed under an earthenware bell with the ends of eir petioles immersed in water. This closed medium was traversed by current of air from which carbonic acid gas had been removed; the carnic acid gas emitted by the leaves was fixed in a solution of barytes. t the end of 144 hours the total amount of carbonic acid gas liberated was spectively 41 mg., 33.1 mg., and 58 mg. per gm. of leaves; this would corspond to 27.8 mg., 22.4 mg. and 39.4 mg. of carbohydrates in $C_6 H_{12} O_6$: ere is therefore a perceptible consumption of carbohydrates, due to resration, in leaves ready to fall. This consumption increases according as e chlorophyll capable of restoring the loss disappears; it reaches a maxium, after which it decreases owing to the gradual death of the tissues.

Several causes bring about the decrease of weight in the leaves when anging colour before falling; so far as carbohydrates are concerned, these periments show that, besides migration towards the stem, and washing used by rain, there is the further factor of consumption due to respiration.

L. V.

58 - **Non-Symbiotic Germination of Orchid Seeds.** — KNUDSON, L., in *Botanical Gazette*, Vol. LXXIII, No. 1, pp. 1-25. Chicago, Jan. 1922.

The writer confirms absolutely the results obtained by L. BERNARD the non-symbiotic germination of orchid seeds (*Laelia, Cattleya* etc.). slightly concentrated liquids, these seeds germinate only when the symotic fungus is present; on the other hand in sufficiently concentrated edia, sterilized seeds grow also in a non-symbiotic manner. The writer uld not bring the sterilized seeds to germinate in dilute nutritive solutions, ich as those of PFEIFFER; but in the same media, to which glucose or fruse had been added, the proportion of germinated seeds was greater when e solution was most concentrated. Fructose is more favourable to germation of the seeds than glucose, which generally caused the development small chlorotic plants. Much starch is accumulated in the young plants. he addition of extracts of potato and beet or of yeast, to the sugary media, as favourable to germination and the same is true for the addition of vaous micro-organisms, such as *Bacillus radicicola* or an Actinomycete. The riter thinks that the symbiotic fungus exerts an action similar to that of gars, inasmuch as it converts starch into sugar or digests other organ- matter; he rejects the hypothesis of BERNARD according to which the ngus causes germination by increasing the concentration of the intracellar fluid.

L. V.

59 - **Variation in the Manganese Content of Leaves according to their Age** (1). — BERTRAND, G., and ROSENBLATT, M., in *Comptes rendus hebdomadaires des Séances de l'Académie des Sciences*, 1st Half-year 1922, Vol. CLXXIV, No. 7, pp. 491-943. Paris, Feb. 13, 1922.

The writers carefully examined the variations in the manganese conit of leaves according to their age. They determined it in leaves taken

(1) See *R.* Nov. 1921, No. 1097, May June 1922, No. 549. (*Ed.*)

simultaneously from a series of plants from the youngest to the oldest. They then repeated this determination for various different species.

Comparing the results obtained with the green and dry matter in the leaves, the plants examined are divided into 4 groups :—

a) That in which the proportion of manganese is greater at the beginning of the growth of the leaf ; it then decreases slowly until growth is complete, when it again increases slightly, *e. g.* beet ;

b) that in which the proportion decreases, as in *a*), but the final increase is rapid and may be so considerable that the old leaves contain more manganese than the young, *e. g.* holly-hock, cytisus, box, yew ;

c) that in which the proportion increases rapidly at first, so that it is greater in leaves which are still young, and then decreases until it falls below that of the leaves of the previous groups, *e. g.* spindle-tree and elder, or nearly approximates to it, *e. g.* lilac, seringa, and privet ;

d) that in which the proportion constantly increases, *e. g.* clematis and Judas tree.

This classification is not absolute as certain plants come under one group or another according as the manganese is considered proportionally to the green or the dry matter.

Analyses of the ash give similar results to those of the leaves ; but the variations are not always parallel in the two cases, apparently because the phenomena of absorption and migration are not quantitatively equal for all mineral substances.

The manganese content has therefore, in a varied degree, a maximum at first, a decrease and a final increase ; it remains to be determined to what extent this variation is in relationship with the biological functions of the plant. A. de B.

1160 - **The Rôle of Chemistry in the Improvement of Plants.** — G. DE VILMORIN, in *Chimie et Industrie*, Vol. 7, No. 5 pp. 864-869. Paris, May 1922.

The writer refers to the chemical methods used in the study of hereditary factors and for the selection of individuals possessing the desired characters and made use of in the Verrières laboratory. He deals with the following plants :— Sugar-beet, mangold, Jerusalem-artichoke, chicory, wheat, potato and plants containing alkaloids.

Sugar-beet. — The writer describes the method of cold aqueous digestion, the principles of which were laid down by LOUIS DE VILMORIN as early as 1850 and practised by him in his laboratory at Verrières. With new and improved apparatus it is possible to make 1000 analyses per day. With this method beets containing invert sugar which are undesirable in sugar refineries can be eliminated.

It is only after careful verification on several generations that the seed is multiplied.

Mangolds. — These are analysed quantitatively by the preceding method as soon as they are pulled at the time when they contain a minimum of invert sugar ; then the dry matter, which in a given variety is approximately proportional to the total sugar content, is determined.

Jerusalem-artichoke. — Here the inulin is determined; for this it is ansformed into reducing sugars with a dilute solution of sulpho-salicylic id.

Chicory. — The dry matter especially is analysed, since chicory is ainly used for torrefaction. Tests are made to discover the inulin con-nt, for it is possible that this plant may in future be used for the extraction levulose.

Wheat. — The bread-making value is mainly considered: the following e determined:— 1) the dry gluten content; 2) the hydration capacity the gluten, by means of the formula

$$\frac{\text{moist gluten}}{\text{dry gluten}} \times 100.$$

Potato. — The fecula is determined by transforming it into soluble rch with picric acid; it is then determined by the saccharometer.

Plants containing alkaloids. — The use of the colorimeter is fully indi-ted, but very noticeable reactions in the case of pure salts are not so clear mixtures. It is quite evident that the analysis must be made for each nt so as to eliminate those that are defective, but as the plants have to replanted, methods which require a small amount of material only ould be used. P. C.

Development of mutilated Seeds of Maize. BROWN, E. B. (Agronomist, Corn Investigations, Office of Cereal Investigations), in *United States Department of Agriculture, Bulletin*, No. 1011, pp. 1-14, 3 pl. bibliography of 9 publications. Washington, D. C., Feb. 23, 1922.

After recalling the previous experiments of SACHS, VAN TIEGHEM, OCISZEWSKI, WOLLNY, STINGL, DELASSUS, DUBARD and URBAIN, UR-IN, ANDRONESCU, the writer gives an account of numerous experiments ich he carried out on seeds of maize. In one series of these experiments, embryo was left intact: the seed was decorticated, or else the endosperm s reduced by cutting the seed across near the wider end, richer in starch; the embryo itself was completely extracted; the seeds were thus more less deprived of reserve material. The experiments were made in the en field at four Experimental Stations and lasted 3 years. The results re uniform: the development of the plants was difficult and late, but ey were not dwarfed; the number of ears was not less than that in the ntrol plots; the seeds deprived of their spermoderm produced even a eater number of ears, but these were lighter; on the whole, the yield of ain was less; the loss was estimated at 5-7 hl. per ha. The decorticated eds gave the smallest yield, not that their vitality was impaired but cause they were more easily affected by surrounding conditions. The st difference was noticed in the seeds which had their starch content duced by cutting one end off: in some cases there was no difference ween plants from such seeds and the control plants.

In another series of experiments, the embryo was cut: the seed being through longitudinally so as to divide it into two approximately equal

customary in Arizona to irrigate twice a week and to harrow between the rows to keep the soil in a better condition of moisture. The first mowing takes place during the latter half of March, the last in November, sometimes early in December. Generally lucern is made into hay for cattle.

The writer carried out numerous investigations on lucerne at the Experimental Stations of the Arizona University, at Yuma, Phoenix and Tucson where the rainfall is only 60, 190 and 340 mm. respectively and where humidity varies very much in the hot season, being 80-90 % from 5 to o'clock in the morning and 25-35 % about 2 p.m.

In 1910 lucern seed was obtained from foreign countries and from Arizona farms and experiments have continued since that time. It should be noted that the seeds of commerce are all impure and often very heterogeneous. To get pure seed the writer enveloped the flowers to protect them against insects, especially *Bruscophagus funebris* the larvae of which prevent the development of seed. Self-fertilisation did not give such good results as artificial pollinisation, which is easily done by rolling the small flowers between the thumb and the forefinger; if several successive pollinisations have to be carried out the fingers should be washed with alcohol at 40° after each pollination. Pollinisation should be repeated every other day during the flowering period. The selected plants can also be propagated by cuttings; these are made about April by cutting cleanly below a node and the cuttings are then planted in a nursery of coarse sand; they are kept shaded and if it is sufficiently moist and warm they take root readily; when they are well rooted the young plants are transplanted temporarily on to soil where the roots grow and the plants get accustomed to sunshine; shortly after, they are planted in the open field.

The writer has compared numerous varieties of lucern with reference to several factors:— height and width of the plants, weight directly after mowing (about the flowering season) and after drying, respective weight of leaves and branches, transpiration (the moisture given off was absorbed by means of phosphoric acid) expressed absolutely and proportionally to the transpiration surface which was carefully measured with a planimeter, etc.

The maximum yield obtained during several years of researches was given by the villous Peruvian lucern 39 a (21.25 kg. per ha.); closely followed by an Italian variety (20.90 kg.) and Peruvian 30° C (20.80 kg.). Peruvian lucern also gave the best results in other experimental fields, thus proving that it is most suitable for the climate. Not only does this variety give a higher yield but it begins to grow at a temperature of 10° C while most of the other varieties require a temperature of at least 13° C but Peruvian lucern is not suitable for cold climates. In Arizona it is still but little grown (1200 ha. out of 74 000), its cultivation is however increasing.

L. V.

1165 - **Experiments with Mangolds.** — LINDHARD, P., in *Tidsskrift for Planteavl* Vol. XXVIII, No. 2, pp. 276-285. Copenhagen, 1922.

The writer describes experiments made with the object of comparing the yield and the dry matter content of mangold roots raised from seed of

he same variety grown in Denmark and in Germany and England. The esults shows that in Denmark the seed produced large roots of good quality, hile in the other countries it produced small badly formed roots ; apart rom that no other influence of the different cultivations on the crop was oticed. The following are the results of 27 experiments made at Tystofte, Lyngby and Askov :—

Crop in qs. per ha. of seed sown :—

In Denmark	In other countries	Difference ±	Average error
700.13	689.54	— 10.59	± 1.80
Percentage of dry matter in the roots: —			
13.13	13.31	+ 0.18	± 0.034

Experiments on the crop of mangolds grown from seed obtained from lected roots of average size, compared with that obtained from small selected roots gave the following results :—

Crop in qs. per ha., seed from :—

mall unselected roots.	Selected roots of average size	Difference
603	624	= 21
Percentage of dry matter in the roots :—		
12.91 %	12.75 %	+ 0.16

A. de B.

36 - **Brazilian textile Plants.** — FEHLINGER, H., in *Der Tropenpflanzer*, Year 24, Nos. 11-12, pp. 173-176. Berlin, Nov.-Dec. 1921.

Brazilian statistics of external trade have shown that Brazil im- rts enormous quantities of textile material, especially jute and hemp, hough its vast plains are suitable for the growth of these two plants. reover numerous native plants furnish good textile fibres. Up to the sent scarcely any attention has been paid to these crops as planters ve been concerned with the growth of coffee and rubber; but at this time ber has to meet strong competition from the Far East and all markets over supplied with coffee ; in these circumstances it is possible that tile plants may be pushed.

A number of native textile plants are already largely used by the In- ns and Creoles, some of which deserve attention. At present Brazil ports only a small quantity of fibre obtained from the bark of two palms : *Leopoldina piassaba* Wall. and *Attalea funifera* Mart., known under the ne of " piassava ". The first of these palms grows in a region difficult access, the valley of the Rio Negro, a northern affluent of the Amazon ; fibre of this palm is more highly valued and the whole output is sent the Manaos market.

This palm is very abundant in the south of the State of Bahia and in north of Espirito Santo, but it abounds also in other places and forms ular forests, even on very poor sandy soils. The bark is removed twice ear ; the yield is 2.5 kg.-5 kg. per tree. The fibres are about 2.5 m.-5 m. g ; the longest are used for sail canvas and the thickest are cut and made p brooms, brushes, sandals, hats.

" Piteira " *Fourcroya gigantea* Vent. is one of the Amaryllidaceæ characterised by leaves 3-4 m. long growing directly from the root, which furnish a fibre used by the natives for making shoes ; well prepared, this fibre might rival Manilla hemp. The Dutch had grown this plant with success and they tried to introduce it also into their Asiatic Colonies ; it is still grown at the present time on some farms. It is suited to all soils, even poor ones. Plants of 4-8 years old give the best fibre and some forty leaves a year can be taken from each plant when they begin to bend and before they turn yellow.

Three of the Malvaceæ give an excellent fibre for bags. The most suitable is " aramina " *Urena Lobata* L., which is found in nearly all tropical countries ; it is from 1.5 m. to 2 m. high and is cut between the two flowerings of February and July ; the fibre, which forms about a quarter of its weight can be extracted by steeping in boiling water ; as the fibres extend into the branches, they have a length of 2 to 3 m. The " papoula of São Francisco " grows wild in Central Brazil, but it has been brought under cultivation ; its fibre is better than that of Manilla jute. Several species of the genus *Sida* are very common in Brazil ; they are small plants not exceeding 50 cm. in height but contain an excellent fibre ; they grow and ripen in 4 months and multiply with extraordinary rapidity ; once introduced they are difficult to extirpate ; well considered cultivation might increase the height and improve the quality.

The " gravata " should also be mentioned, which include two of the Bromeliaceæ, *Ananas sagenaria* Schult. and *Bromelia Karatas* L., delicate in appearance, but more vigorous than the " piteira ", which looks much more robust ; its leaves which are sometimes as long as 2 m. give a fine glossy fibre with great powers of resistance ; its cultivation requires but little attention, except as regards adequate irrigation ; the outer skin is strong and makes the extraction of the fibre difficult ; but this defect could be eliminated by selection. L. V

1167 - **Observations on the Flower of the Olive Tree.** — I. CAMPBELL, C., Studi sull'olivo in terra di Bari, *Pubblicazioni della Stazione agraria sperimentale in Bari*, No. 1, pp. 84, 1 full page coloured plate. Bari, Dec. 1921. — II. OCCHIALINI, O., Osservazioni sul fiore dell'olivo nelle varietà della Riviera ligure, *Oleum, Rivista mensile dell'olicoltura, dell'Oleificio e del Commercio oleario pubblicata a cura del R. Oleificio sperimentale di Porto Maurizio*, Vol. I, No. 5, pp. 93-95. Porto Maurizio, Aug. 1922.

I. — The writer has made a study of the flowers of the olive since 1900. In this statement he describes the observations he made in " Terra di Bari " which enabled him to confirm the fact that among olive trees which fructify normally there are a few, either isolated trees or groups, which do not flower, or which, while flowering fairly profusely, give little or no fruit. In these cases most of the flowers have a reduced pistil. This reduction of the pistil may vary between a state of perfect development and a rudimentary condition. On the same tree, the proportion of " imperfect " flowers varies from one branch to another and in different years. If branches of a fruitful olive tree are grafted on a tree which bears no fruit, the latter becomes fruitful and vice versa. Pruning, manuring, spraying

ith sulphate of copper etc. have no influence on this " imperfection " f the flowers. Imperfection cannot therefore be attributed to causes of a athological kind ; the fact that unfruitful trees grow alongside normal rees confirms this view. THEOPHRASTUS, 300 years B. C., had already oted that the phenomenon was peculiar to certain places, that is to say as inherent in the trees themselves, and independent of pathological nditions.

" The presence of staminiferous flowers on plants produced from seed d bearing hermaphrodite flowers only is not only found in the olive but so in the peach, almond and several other spontaneous plants, and also the vine " (1).

II. — Observations on olives of the eastern " Riviera Ligure " and, ecially in the trees in the grounds of the " R. Scuola di Agricoltura di Ilario Ligure " which belong to the varieties generally grown in Liguria, mely :— " Lavagnina " or " Taggiasca " — " Pignola " — " Rossese " " Ogliastra — " Croa ". Some trees of the " Ascolana " variety were so observed.

The " Lavagnina " variety is considered best on account of its very ndant flowering and its fleshy fruit which is rich in oil of good quality, ing a yield which may exceed 25 %.

In this variety flowers with reduced pistils or without pistils are very e and in a few trees only has their number been as many as 8 %. The ignola " variety is much liked on account of its high productivity and excellent quality of its oil, the yield of which is 20 % ; flowers with re-ed pistils or without any are fairly numerous :— 38 to 49 %.

The fruit of the " Rossese " variety is larger than that of the preceding ieties ; the yield of oil is poor (14 %), but the quality is excellent ; it vers abundantly but its productivity is unsatisfactory. Staminiferous vers are very numerous, 74 to 89 %.

Trees of the " Ascolana " variety observed by the writer have always en a poor crop of olives ; they had the maximum of unproductive vers, 95 %.

All the trees under observation were healthy, vigorous and still young. Manuring was on a basis of green manure, beans, farmyard and other anic manures ; pruning, and digging the soil had not the slightest influence the formation of the flower.

It is chiefly on trees with a high percentage of staminiferous flowers a few hermaphrodite flowers are found on the topmost part of the n of the tree (2). F. D.

(1) See *R.* Feb. 1919, No. 174 : *R.* Feb. 1921, No. 131. (*Ed.*)

(2) The observations of Professors CAMPBELL and OCCHIALINI confirm Prof. PIROTTA's ld observations. On the other hand, according to Prof. PETRI (Studies on the dis of the olive tree, Rome, 1914) unproductiveness of olive trees is a consequence of onditions of nutrition of the tree and at the same time an indirect consequence of all nternal and external influence which may modify these conditions. He therefore s that rational cultivation of olives is very useful for avoiding or considerably reducing nuiency of the trees to produce staminiferous flowers.
ee *R.* July and Aug. 1920, No. 725. (*Ed.*)

1168 - **Experimental Stations for Oleaginous Plants in French African Colonies.** — BAILLAUD, E., in *Bulletin des Matières grasses de l'Institut Colonial de Marseille*, Nos. 1-2, pp. 1-56. Marseilles, 1922.

Groundnuts and oil palms stand first among colonial oleaginous plants, and are the subject of the two reports of the writer which were presented to the Fats Section of the Colonial High Council for the establishment of Stations in Africa specially charged with the study of these plants. It was intended that these Stations should be founded with the funds derived from the liquidation of the Oil Consortium founded during the war.

The import trade of fats in France in 1913 amounted to a total of 465 687 t. equivalent weight in oil : the export trade of fats from French Colonies in 1913 was 143 425 t., of which 99 551 t. were consigned to France.

Groundnut. — The Station intended for the study of this plant is at M' Bambey, in Senegal. Its programme includes two stages : — selection of the seed, and the propagation of selected seed. For the former it will be necessary to study all existing types of groundnut and to search for pure lines which will lead to the preservation of a few pure forms from which selection will start. Adaptation to various soils, methods of cultivation, the influence of chemical manures and farmyard manure, the diseases and insects which attack the crop, must all be studied. For this purpose 100 ha. of land will be required, half of sandy soil and the other half of sandy-clay soil. When these studies have led to definite results and the best types have been found, production of the selected seed commercially will be taken up and about 500 ha. will be devoted to the purpose. The estimates for carrying out this programme in five years are fixed at 3 500 000 fr. The writer however criticises the programme of DENIS Inspector General of Agriculture for French West Africa, for in it the question is mainly the cultivation of large areas with the most modern mechanical means and the construction of numerous buildings, while scientific questions, which are most important and should take precedence, are not sufficiently prominent.

Oil-Palm. — The establishment of two Stations for this Palm, one on the Ivory Coast and the other at Dahomey, is proposed. The first should serve for the direct working of plantations under the supervision of technical officers, for the introduction of machinery for dealing with the drupes, for forest exploration with the object of the creation of plantations under European management ; the second would deal with the industrial aspect of the treatment of the fruit, with the propagation of selected types, with the rational working of plantations, etc. In short it is rather a question of a wide programme of industrial working than of a programme of research.

For the establishment of the Station at Mé (Ivory Coast), a total expenditure, from 1922 to 1928, of 4 480 400 fr. is estimated ; from 1929 the revenue should exceed the outgoings with a profit increasing up to 193 and constant as from 1936. For the Station at Pobe (Dahomey), the estimate of expenditure for establishment up to 1928 is 3 014 000 fr., while the profits are estimated similarly as for the Mé Station.

After criticising in detail the proposed arrangements, the writer concludes his report by pointing out that it is unwise to assume that the French Colonies will easily be able to supply France with all the crude fats which may be required, since the increase in colonial production is proportional to the increase in population and to the development of means of transport. The proposed schemes are too costly, as the total amount exceeds 11 million francs, and moreover they are not principally concerned with scientific research, but rather with the creation of large plantations, the success of which is largely dependent on the solution of questions which have yet to be studied. The Stations ought to be organised on different lines and should be mainly experimental. For the study and solution of the problems involved and for securing the large funds which will be required — the 5 million francs from the former Oil Consortium being insufficient — the forces of the Colonial Government and of the manufacturers and merchants interested in the matter should be combined in a single association. So powerful an association would be able to make its experimental work cover not only one or two Colonies, but the whole French Colonial Empire.

F. C.

1169 - **Less known vegetable Oils and Fats of Japan.** — SPANN, A., in *Der Tropenpflanzen*, Year 24, Nos. 11-12, pp. 161-169. Berlin, Nov.-Dec. 1921.

Together with the oils of well known seeds, other oils or rather other vegetable fats more or less local and derived from the various plants, which the writer describes, are used in Japan.

Aleurites cordata Muell. — A tree called " Abura-Kiri " oleaginous " Kiri " in Japan because it closely resembles *Paulownia imperialis* which is commonly known there as " Kiri ". It is grown in sub-tropical countries and its fruit yields a siccative oil called " dokuye no abura " which thickens and dries with extraordinary rapidity and in this respect it appears to be unrivalled. It is kept in tightly closed receptacles and its chief use is for joinery and especially for filling up surface cracks in furniture before lacquering. It is also used for caulking boats and generally for preserving wood. Owing to these uses it is commonly called " oil for wood ". The oil is also used for lubricating machinery, waterproofing paper and even as a purgative ; in the crude condition it is used also for fuel. It is chiefly valued because it is quite colourless, inodorous and tasteless. The cold process is used in the manufacture and the refuse, which is abundant and has been analysed by TESCA, would make a good manure.

Perilla ocymoides. — This Labiate plant is grown in the northern part of Japan ; but almost all the seed is imported into Japan from China and specially from Korea, where it grows wild and is also partly cultivated ; in Japan, it bears the name of " Yeogoma " or " Jingomashi ". The small round seeds contain about 46 % of fats and much protein (KELLNER'S analysis) ; they are edible, and the extracted oil is used as a condiment, for burning, for waterproofing paper for lanterns, umbrellas, etc. and for mixing with lacquer. The leaves of *Perilla* contain an aromatic oil which keeps off mosquitoes. The writer gives some information regarding the cultivation of this plant.

Camelia japonica. — This plant grows wild, but is also cultivated as an ornamental plant ; its large seeds, which weigh up to 3 gm. each, are 42 % husk ; the kernel contains up to 70 % of oil ; the seeds are dried in the sun, and then pressed whole or husked, generally by heat process. Commercial Camelia oil, called " tsubaki no abura ", is light yellow and fragrant when of good quality ; it is chiefly used for toilet purposes and also for lubricating delicate machinery, watches, arms, and in some places it is used for food purposes. It is often adulterated with other oils. Japan exports this oil to neighbouring countries.

Camelia sasanqua Thumb. — This camelia, unlike others, flowers in winter ; the seeds, which are smaller and contain less oil than those of the preceding species, furnish an otherwise similar product. In addition to the seeds of these two Camelias the seeds of tea, which contain about 40 % of oil, are largely used in China, but not in Japan, for the extraction of oil.

Cinnamomum camphora Nees. — The Japanese name is " Kusu no ki ". This tree produces small seeds which contain about 42.5 % of fats, extracted by heat process and transformed at ordinary temperature into a crystalline mass with a fragrant scent like that of cocoa-butter. It must not be confounded with oil of camphor, a secondary product of the distillation of the wood of the same tree.

Machilus Thumbergii Sieb. and Zuc. — In Japan this tree bears the name of " Isukuru " or dog's camphor. It is one of the Lauraceæ and the seeds, which are larger than those previously mentioned, yield 65 % of fats. Other varieties of the Lauraceæ are also used, but not *Laurus nobilis*, the seeds of which are rich in a fat which is extracted in certain countries.

Torreya nucifera Sieb. and Zuc. — This is one of the wild Tanaceæ called by the Japanese " Kaya " ; the fruit furnishes a siccative oil, used in cabinet-work and also for waterproofing paper and as food.

Cephalotaxus drupacea Sieb. and Zucc. — This is also one of the Tanaceæ, the oil being used for similar purposes ; it is however not edible.

L. V.

1170 – **Pressure in the Roots of *Hevea brasiliensis*.** — Bobiljoff, W., in *Archief voor de Rubbercultur*, Year VI, No. 3, pp. 113-124. Buitenzorg, March 1922.

The writer has studied the pressure in the roots of *Hevea brasiliensis*, and has arrived at the following conclusions :—

1) The pressure in the roots is both positive and negative. In comparison with other tropical trees which have been examined, *Hevea* shows the lowest pressure. Trees in full leaf have the highest pressure namely 1442 atmospheres.

2) In *Hevea* the pressure in the roots shows scarcely any variation in the various periods of growth of the leaves. During the winter period, a slight tendency towards negative pressure was observed.

3) Changes in weather have no influence on the pressure developed in the roots of *Hevea*, so that during the rainy season no higher pressure was observed than during the dry season.

4) Different hours of the day have hardly any material influence on the pressure, though slight fluctuations have been noted during the night and a slight increase was observed during the early hours of the morning.

5) The insensibility of the pressure in the roots to changes in external conditions in *Hevea*, is explained to a certain extent by the fact that these changes have only a slight influence on the activity of the roots of the tree.

6) It is incorrect to speak of the direct influence of the pressure in the roots of *Hevea* on its production by driving the latex out of the laticiferous vessels or by causing the latex to ascend from the laticiferous vessels of the root to the cut surface.

7) The low pressure in the roots of *Hevea* is only indirectly important, because of its small influence on the life of the tree.

8) There is more intense activity in the roots of young *Hevea* plants than in those of the full grown tree, as may be ascertained by incision. The pressures recorded are relatively low (the highest was 1416 atmospheres), but they remain constant for several days, when they have reached the maximum. F. C.

1171 - **Camphor in Tonkin** (1). — CREVOST, CH. and DE FENIS, F., in *Bulletin Économique de l'Indochine*, Year XXIV, No. 149, pp. 367-427, 22 figs. Hanoi-Haiphong, July-Aug. 1921.

This paper gives information regarding experiments recently made by the various French Colonies for the improvement of their agricultural, industrial and commercial resources, the writer having been originally instructed in 1904 by the Tonkin Government to ascertain the importance of the growth of camphor yielding plants in the Province of Bâc-Giang. After a short historical account of the more recent works published on the subject of camphor from 1903 to 1920, the writers made a botanical study of camphor trees. These are classified under 3 principal species growing wild in Indo-China.

1) *Cinnamomum Camphora* Nées and Eberm. — *Laurus Camphora* L. — *Camphora officinarum*; grows in Yên-thê (Province of Bâc-Giang) and in the Provinces of N. Annam. It is called "Râhuong" in Annamite, "Mây Kao chuong", "Mây Khao Khinh", "May Khao hom" in Thai, "Long nao" in Chinese.

2) *Cinnamomum Balansae* H. Lec., the wood of which has the smell of fennel. This tree has been of no importance as a producer of camphor, but it may be of interest on account of its essential oil.

3) *Cinnamomum Simondii* H. Lec. which is very probably the camphor tree worked in Kouang-si. The species *C. parthenoxylon* Meissn., false Camphor (in Annamite "Vu huong") and *C. ilicioides* A. Chevalier (in Annamite "Gu huong") should doubtless be considered as synonyms of *C. Simondii* H. Lec. and *C. balansae* H. Lec. To these species should be added *C. cecidodaphne* var. *caniflora*.

(1) See *R.* Sept. 1921, No. 915. (*Ed.*)

Besides these camphor yielding trees other plants which furnish similar products may be mentioned, namely:— *Blumea balsamifera* D. C. (1) (in Annamite " Dai bi " and " Cô bang phien ") which produces a levorotary borneol which can by oxidation give a levorotary camphor, identical with the camphor of Japan, except as regards rotary power. Another of the Compositæ, resembling an Inula, was found by the writers in the Yen-thé forest and some Chinese merchants have stated that a special essence called " Luc-nhi-Linh " in Chinese, is extracted from it.

The writers deal in a separate chapter with the chemical composition of camphor, its derivatives and the subject of synthetic camphor which is very important in its relation to natural camphor. Regarding synthetic camphor, it is important to note that Prof. SOMMELET of the Paris faculty of chemistry has stated that the product cannot be considered as a medicinal drug because most of the artificial camphors have no action on polarised light, while natural camphor is strongly dextrorotary, but that it can be used for the manufacture of celluloid provided that it is freed from chlorine which remains as an impurity consequent on the use of hydrochlorate of pinene as raw material.

The distillation of camphor is very important and the yield is largely proportional to the kind of apparatus used. Thus with the method used in Japan and Formosa and described by DAVIDSON a yield of 2.16 % by weight is obtained. On the other hand with the apparatus of Prof. MORIYO of the College of Agriculture at the University of Tokio an average yield of 4.22 % in addition to a yield of oil of 1 to 1.50 % of the wood used, was obtained. According to this authority a smaller yield of camphor and a larger yield of oil is obtained in summer and the contrary in winter.

	Weight distilled	Crude Camphor	Camphor oil
	kg.	kg.	kg.
In Summer	120	2.35	1.60
In Winter	120	3	0.63

During the last few years distillation of the leaves of the camphor tree, which previously was entirely neglected, has become very important and the writers, after having examined and compared the results obtained by men who have studied and inquired into the question, made experiments on samples from Tonkin. On a basis of the smell of bruised leaves, which varies with different trees, they fixed three classes of leaves each of which gave a different yield of camphor. Leaves of the first class, which smelt fairly strongly of camphor when bruised, produced from 0.48 to 0.56 %. those of the second class, which gave out a faint smell of camphor when bruised, yielded from 0.25 to 0.30 %; those of the third class, which smelt like

(2) See *R.* Feb. 1922, No. 171. (*Ed.*)

pippins when bruised, gave no trace of camphor. The most favourable area for the growth of the camphor tree stretches from the 20th to the 25th degree of north latitude. In Formosa trees in the mountains give a higher yield than those in the plains; those growing in open places and much exposed to the sun give a higher yield than those which grow under shade in damp valleys.

Heavy, well drained, deeply tilled clay soils suit camphor trees best. The Camphor tree requires plenty of potash and lime; in Ceylon 196 lbs. of lime and 87 lbs. of potash (in the form of the ashes of refuse from the distillation of the leaves) are used per acre.

The germination of the seeds is hastened by immersion in a vessel of tepid water at 25°: this enables the good seeds, which are heavy and sink to the bottom, to be distinguished. The fruit is pulped by means of special iron sieves. This operation facilitates the germination of the seed which takes place 3 months later. When the young plants reach a height of 30-45 cm. they are finally transplanted.

The camphor tree is also propagated by cuttings, by layering and by grafting. In Tonkin the best season for transplanting is from February to March.

The spacing between the young plants varies; it may be:—

1) 2.40 m. in squares giving about 700 plants per hectare;

2) 3 m. in squares; about 450 plants per ha.;

3) plants 1.80 m. apart in rows 4.50 m. apart; about 500 plants per ha.

In Tonkin, on good soil, when 3 years old the plants are 2 m. to 2.50 m. high and when 5 or 6 years old they reach a height of 4.50 m.

The leaves are gathered by means of special apparatus.

According to the spacing in the plantations the yield obtained is:—

1) 70 kg. of camphor per ha. in the first type of plantation;

2) 45 kg. per ha. in the second; and

3) 50 kg. per ha. in the third.

In the course of journeys made in 1920, the writers investigated the camphor resources of various districts in Tonkin (Lang-son, Bắc-giang, Thai-nguyên and Quang-si) and discovered some trees several centuries old which they describe in their paper.

According to E. GILDEMEISTER and Fr. HOFFMANN, the industrial uses of camphor and its derivatives are the following:—

Spirit of Camphor, free from solid camphor, is used as a fuel oil by the poorer classes in Japan. It is also used as a solvent of resin in the manufacture of lacquer. The lamp-black resulting from its combustion is used in the manufacture of Indian-ink.

In Europe, safrol is extracted from essence of camphor and the residual spirit of this preparation has many uses as light or heavy oil of camphor.

Camphor forms part of the composition of celluloid. It is also largely used in pharmacy.

The writers conclude their paper with a reference to the fact that,

by the local Government Decree of Dec. 20, 1920, they procured the prohibition of the felling of camphor trees of all ages in Tonkin and they hope that the competent authorities will create a camphor Service whose duties would include :—

1) The listing and registration, village by village, of the best seed producing camphor trees ;

2) The collection from these selected trees of seed in sufficient quantity to allow the cultivation of these trees to be spread over as large an area as possible.

3) The making generally known by means of active propaganda, the various processes of extracting camphor from the leaves.

4) The management of a certain number of experimental plantations in different districts in order to ascertain the most suitable place for planting on a large scale.

5) The observation and following up of the work that is being done in Formosa in the matter of improving camphor planting and the processes of manufacturing camphor.

F. C.

1172 — **Copal.** — J. P. and F. D., in *Congo, Revue général de la Colonie Belge*, Year II, Vol. II, No. 4, pp. 543-557. Brussels, 1921 ; Year III, Vol. I, No. 2, pp. 208-230, figs. 2. Brussels, 1922.

The exports of copal from the Belgian Congo from 1902, in which year 339 640 kg. were exported, to 1912, when the export amounted to 3 755 801 kg., have increased more than ten-fold. Owing to the great economic value of the product, which has increased at the present time by 1500 %, the writers undertook the study here reviewed.

The name "copal" is given to a resin secreted by certain trees belonging to the Leguminosæ. Commercially this resin is known by various names :— Brazil "animi or animé resin" ; Bombay, Calcutta or East Indian, Copal ; "Kanri", "cowrie" or "cowdee" copal, Manilla Copal, Accra Copal, which is commonly called "gum animé" in English. This product is collected on the East Coast of Africa, in Zanzibar, Madagascar, Sierra-Leone, Congo, Guinea, Angola, Gold-Coast, Southern Nigeria, Brazil, Australia and New Zealand.

The African commercial varieties are the most valued in the varnish industry ; they include 15 varieties, each of which have several qualities which only a very expert eye can distinguish.

Copal is obtained from living trees as well as found in a fossil state buried in the ground ; for this reason the specific botanical origin of certain copals remains unknown or is very uncertain.

On the East Coast of Africa, at Zanzibar and in Madagascar the commonest species which yield the greater part of the resin are :— *Hymoenea verrucosa* and *Trachylobium verrucosum* ; in West Africa, *Copaifera copallina*, *c. Guibourtiana* and *c. demensei* ; American copal is derived exclusively from *Hymoenea Courbaril* ; the copal of Australia, New Zealand and Manilla is secreted by conifers of the genus *Dammara*.

The resin occurs in 3 forms :—

1) green or soft copal ;.
2) fossil or hard copal ;
3) semi-fossil or semi-hard copal.

The first is collected direct from the tree and sold immediately after collection ; the second is found in the ground in more or less irregular voluminous masses, often bituminous ; semi-fossil copal has been buried in the ground for a shorter time and is never completely bituminised. Soft copal becomes milky and opaque in boiling water, while hard copal does not change.

The colour and appearance of copals vary according to the commercial variety.

Copals are divided into 5 categories according to their geographical origin :—

1) East African copals ;
2) West African copals ;
3) New Zealand Kauri copal ;
4) Manilla copal ;
5) American copals.

I. East African copals.

a) *Madagascar copal* derived from *H. verrucosa*, locally called " Taurouk Rouchi ", and includes three kinds :— green, fossil and semi-fossil.

b) *Zanzibar copal* found only in a fossil state ; the tree which produced it has disappeared but has been identified by Kirk as being *T. verrucosum* which bears the name " Niti sandarusi " in the country, while the resin is called " Sandarusi ya nitin ". Zanzibar copal is the hardest of all and most in demand.

c) *Mozambique copal* derived from *T. verrucosum*, a species which tends to disappear to such an extent that at present it is hardly ever found except in a fossil state.

d) *Inyambana copal.* — This is a kind of copal which is seen in German markets, and is produced by *Copaifera Gorskiana* Benth. = *Gorskia conjugata* Bolle ; the natives call it " staka " or " inthalaka ".

II. West African copals.

a) *Sierra-Leone copal.* — Produced by *C. guibourtiana.*

b) *Guinea copal.* — Produced by *C. copallina.*

c) *Belgian Congo copals* secreted by 3 species of *Copaifera* :— *C. arnoldiana* de Wild., *C. demeusei* Harem, *C. Laurentii* de Wild. The following are the amounts exported during the last ten years :—

Year 1909	t. 826	Year 1915.	t. 4 260
» 1910	» 976	» 1916.	» 8 677
» 1911	» 2 139	» 1917.	» 6 911
» 1912	» 3 756	» 1918.	» 3 611
» 1913	» 4 698	» 1919.	» 6 231
» 1914	» 6 693	» 1920.	» 13 250

The most valuable commercial kinds in the Antwerp market are:—

1) Selected Congo copal gum, white.
2) Selected Congo copal gum, slightly yellowish.
3) Selected Congo copal gum, amber.
4) Selected Congo copal gum, brownish.

Next comes common unselected Congo copal.

In 1915 the price of Congo copal varied between 800 and 1000 fr. per t., in 1920 it reached 5500 fr. per t.; at present the price is falling.

d) *Gabon copal.*

e) *Angola copal*, always of fossil origin.

f) *Gold-Coast copal*, produced by a species of tree which grows in the Ashantee and Ikim forests and is not well known botanically.

g) *Nigerian copal*, produced by *Cyanothyrsus oblongus* = *C. Ogea* = *Daniella oblonga.*

h) *Benguela copal.*

III. NEW-ZEALAND KAURI COPAL. — The tree of origin is *Dammara australis*, a conifer which grows between 34°.5' and 37°.5' south latitude.

In New Caledonia copal is derived from *Dammara ovata.*

IV. MANILLA COPAL. — This is the least valuable commercial copal and is produced by *Dammara orientalis* = *Agathis alba.* It is not obtained from *Vateria indica*, which is an arborescent Dipterocarp.

V. AMERICAN COPALS. — These are almost all produced by *H. Courbaril* one of the Leguminosæ common in Brazil, the Antilles, Venezuela Mexico and Guiana; it occurs in the green and also in a semi-fossil form

The best valued quality in copal is hardness.

In decreasing order of hardness come:—

Zanzibar	copal	Angola	copal
Mozambique	»	Benguela	»
Sierra-Leone	»	New-Zealand	»
Belgian Congo	»	Indian	»
Gaboon	»	Brazil	»

Of the characteristics which determine the market value of copals next in order come transparency, density (in inverse proportion), colour and resistance to fusion, the minima temperatures of which are as follows:—

Brazil	copal	77°
Kauri	»	110°
Angola	»	125°
East African	»	134°
Semi-fossil Zanzibar	»	139°
Fossil Zanzibar	»	158°

Bags and boxes made of thin planks, giving insufficient protection to the contents and causing the pieces to adhere by pressure should not be used for packing. Copal is chiefly used for making thick varnishes and lacquers, and its other uses are of little importance. Spirit of copal is used to adulterate spirit of turpentine. P. C.

173 - **The Chemistry and Manufacture of Tobacco.** — CHESLEY, A. S. (Chemist, The American Tobacco Co., New York) in *The Journal of Industrial and Engineering Chemistry*, Vol. XIV, No. 9, pp. 817-819. Washington, D. C., Sept. 1922.

The writer deals with the influence which chemical research has exercised on the manuring and cultivation of the tobacco plant, on the control of its diseases and on the different methods of manufacturing tobacco. The proportion of ammonia, phosphoric acid and potash in the soil has special importance for the growth of tobacco. Want of ammonia checks growth, excess of ammonia produces a strong, dark tobacco with a higher nicotine content.

A manure deficient in potash or containing chlorides produces a tobacco which does not burn well. Lime favours certain diseases. De-budding improves and increases the size of the leaves because of the greater concentration of the available plant food. A few years ago potassium nitrate used to be added to tobacco during manufacture to make it burn better; now the use of suitable manures makes this unnecessary. Often bad burning or bad odour is due to the paper, which may contain impurities, difficult to analyse chemically, but perceptible by the sense of smell. Other improvements were made in the manufacture, specially in the matter of the amount of moisture in the tobacco, which was regulated so as to prevent mould and to obtain products of unvarying composition. During the war chemical science succeeded in replacing varieties imported into the United States by other native varieties which had never previously been grown and gave good results. A. DE B.

174 - **Temporary and permanent Shading of Cocoa, Coffee, etc. in the Belgian Congo.** — KINDS, R., in *Bulletin de l'Association des Planteurs de Caoutchouc et autres produits coloniaux*, Vol. IX, Nos. 4 and 5, pp. 86-89. Antwerp, 1922.

The question of temporary and permanent shading for cocoa, coffee and plantations is very important, and has long engaged the attention of Colonial planters.

Experiments have therefore been made in the Belgian Congo, especially at Maymbé, as the question is of special interest in this region owing to the low altitude, the high temperature during the rainy season, the irregularity and frequent scarcity of the rainfall and the long duration of the dry season.

Temporary shade. — Banana-trees are used for temporary shade; they are quite successful where the soil is very fertile and rainfall is abundant and regular, provided that they are removed in good time. As however removal entails much labour it is not carried out to the great detriment of the plantations. The writer long ago recommended that the banana tree, which has many drawbacks as a shade plant, should be replaced in the Belgian Congo by "Ambrevade" which is superior to the others (*Clitoria cajanifolia, Leucæna glauca, Indigofera, Tephrosia, Sesbania ægyptiaca, Ricinus communis*, etc.) used for the same purpose.

In the first place "Ambrevade" has the advantage of being a soil improver; it also grows rapidly into a shrub and attains a height of 2 to 3 m.; its leaflets are small and do not hinder the rain and mist from

reaching the cultivated plants, its roots are taproots and it does not require much water; it can be lopped as desired and disappears through exhaustion in two or three years, and finally it yields seeds of high food value. Sowings should be made in pockets, preferably two or three months before the cocoa is planted, or immediately after transplantation; two or three seeds are sown in each pocket and covered with two or three cm. of earth; when they spring up only a single plant is left to grow per pocket. In sowing it is important to understand thoroughly how to arrange the direction of the shade plants which should have reference to the sun, dominant winds, etc. South of the Equator, when two shade plants are used for each cocoa plant, one should be placed to the north-east and the other to the north-west forming, with the cocoa plant, a triangle with sides 50-60 cm. long; when three plants are used, one should be to the north, the second to the east and the third to the west. The orientation will be the reverse in the zone situated to the north of the Equator.

There are two species of "Ambrevade"; one, the greater "Ambrevade" (*Cajanus bicolor*), is the better because it has a larger growth and two plants are enough to shade a cocoa plant; the other, the lesser "Ambrevade" (*Cajanus flavus*), requires on the other hand three plants per cocoa plant. During the rainy season the shrubs should be lopped and shortened to 1 m., but exact data are at present lacking to show whether the cut branches should be left on the ground or whether they should be burnt.

Permanent shade. — The writer recommends for this purpose in the Congo the selection of trees with the following properties:—

1) articulated petioles and moveable leaflets so as to avoid preventing rain and moisture from reaching the plants below;

2) deciduous leaves, so that the trees may not dry up the soil by continual transpiration; they are less attractive to insects and in case of attack the insect can be destroyed by burning the leaves. It may be objected that trees with these properties would not shade the plantations during part of the dry season, but this objection is unimportant because, during that period, these trees bear numerous dry pods which, as regards shade, act similarly to leaves, and shade during the dry cold season is not so important as during the hot season. *Selection of species of shade trees*:— The writer has tried *Erythrina lithosperma* (Dadop) *Albizzia stipulata*, *A. moluccana*, *Leucæna glauca*, *Deguelia macrophylla Cæsalpinia dasyrachis*, *Albizzia Lebbek*, *Inga Saman*, etc., but he considers that the best are *A. stipulata* and *L. glauca*; if these trees cannot be obtained, *A. Lebbek* and *I. Saman* can be used.

Method of planting, spacing, etc. — Young seedlings must be used not cuttings which do not stand wind and whose spreading roots would be injurious to the plants requiring shade; it is a good plan to plant a certain number of "ambrevade" at the same time as the permanent shade trees, for the better shading of the cocoa and coffee plants while young. These temporary shade plants should be got rid of at the proper time.

he permanent shade trees should be planted every 4 m. alternately with cocoa or coffee plant; if trees of larger growth are used they should e planted 12 m. apart so as not to give too much shade to the plantation. loreover, if the shade trees are planted every 4 or 8 m. a certain number ould be lopped when they had grown up and the remaining trees would ave slender trunks. It has also been suggested, instead of planting dinary shade trees, to plant *Elaeis* which would be left to grow when ie cocoa in the plantation was exhausted after 10 or 12 years, as hap- ns in some places; there would then be a plantation of *Elaeis* in place cocoa. At high altitudes, as coffee plantations require less shade, the rmanent shade trees can be spaced from 10 to 15 m. apart according the aspect of the ground.

F. S.

75 - **The Cultivation of *Pyrethrum* in Switzerland.** — FAES, H. (Chef de la Station fédérale d'essais viticoles de Lausanne), in *Tirage à part de l'Annuaire agricole de la Suisse* 1921, pamph. of 6 pages, figs. 3 Lausanne.

The insecticide powder obtained from Pyrethrum (*P. cinerariæfo- um*) is very effective against Cochylis and is obtained by pounding the ied inflorescence of the plant. It is found in a wild state and cultivated Montenegro, Dalmatia, Herzegovina and in the Quarnero islands (Is- ia) up to an altitude of about 1000 m.

The powder obtained is specially active if it comes from half-closed withered flowers. Unfortunately it is difficult to recognise under the croscope whether the powder is that of flowers picked green or withered. ie writer undertook the cultivation of the plant in Switzerland having gard to the difficulties of procuring authentic powder of good quality. hen collecting the seed it must be remembered that it is situated below e "florets" which look like a floral receptacle.

Sowing may be done either in April-May, or in July-August as soon the seed is gathered. Spring sowing gives better results than later, ice in the plantation, plants are ready for planting out in the autumn the same year.

Sowing should be done in rows 20 cm. apart. The seed should not covered but simply pressed into the soil and heaped over with leaves fresh farmyard manure.

Watering and light weedings are indispensable.

Final planting should be done on well prepared soil without special nuring. Ground with a south aspect and slightly stoney, is suitable. e plant does not tolerate wood ashes. Planting is done in rows 60 cm. rt, the spacing of the plants in the lines being 50 cm. While the plants taking root water moderately. During growth weeding without wa- ng is required.

After gathering the flowers the peduncles should be cut with a sickle. Pyrethrum does not begin to bear freely until the second year. For hering the flowers a dry, sunny day should be chosen. The flowers uld be dried in the shade and can be gathered by hand or by using hears.

The writer obtained the following yields :— 1500 plants growing on 450 sq. m. of land produced 30 kg. of dry flowers in the 2nd year ; 1 kg. of dry flowers yields 6 kg. of concentrated solution of pyrethrum-soap which diluted to 60 litres is sufficient for treating 450 sq. m. of vines at normal spacing. It should be borne in mind that this solution should only be used on caterpillars of the first generation, for those of the second generation get into the seed as soon as they hatch out. P. S.

1176 - **Acclimatisation in France of *Spartina Townsendi*, a Soil-binding, Forage and Paper yielding Plant.** — CORBIÈRES, and CHEVALIER, in *Bulletin de la Société Nationale d'Acclimatation*, Year 69, No. 5, p. 147. Paris, Aug. 1922.

For some time *Spartina Townsendi* (1) one of the Poaceæ native to America, which spread rapidly and is useful for fixing loose sands, has been found abundantly at the mouth of the Vire (Manche). This plant when young is excellent forage for cattle, and when full grown serves for the manufacture of pulp for paper. F. D.

1177 - **Study on the Pollen of Fruit Trees.** — See No. 1155 of this *Bulletin*.

1178 - **Influence of Grafting on the Resistance of Aurantiaceae to Cold.** — COUDERC, G., in *La Parfumerie Moderne*, Year 15, No. 8, 147-151. Lyons, Aug. 1922.

The writer, a breeder of the vines which are named after him, has carried out experiments since 1889 on the resistance of Aurantiaceæ to cold. They are based on two principles :— 1) Grafting on Citrus (*Citrus triptera* Desf., the Siberian orange) ; 2) Selection of seedling plants.

The work already done on this subject is reviewed and the resistance of Japanese orange trees (*Citrus japonica* Thun. and varieties) is noted.

The grafting of Agrumes on *C. triptera* is considered in Algeria to dwarf the grafts, but the writer has been able to ascertain that the tree so produced runs to flower in an extraordinary manner, which is worthy of consideration when growing Agrumes for scent. By selection of seedling plants the writer has been able to get, for all species of Citrus, individuals more than ordinarily resistant to cold. Plants which have stood cold (−9°, −10° C. at Aubenas, where the writer worked) and which did not lose their leaves from frost, are grafted on *C. triptera* and stand cold as well as the Japanese Citrus (−14° C). The writer describes the method of grafting Agrumes on *C. triptera* and the precautions to be taken.

The conclusions which he draws from his experiments are as follows :— This grafting will enable the growth of Agrumes to be extended almost throughout the zone of the olive tree, with the exception of low-lying places and on plains which are subject to hard white frosts : the maritime regions of the West of France, where *Acacia dealbata*, commonly called Mimosa, does not suffer from frost, would be suitable for such cultivation ; the

(1) According to the *Index Kewensis*, *Spartina Townsendi* is a synonym of *S. stricta* which is found, in Italy in places inundated by brackish water near Venice, Monfalcone, Aquileja, etc. G. ARCANGELI, *La Flora italiana*, Loescher, Turin-Rome, 1894. (*Ed.*)

rafting of the Seville orange on *C. triptera* will enable a large quantity f flowers for the manufacture of perfume to be obtained without risk om frost; the durability of the grafts may be depended upon.

P. C.

179 - **Phylloxera-Resistant Vinestock.** — BIOLETTI, F. T., FLOSSFEDER, C. H., and WAY, A. E., in *College of Agriculture, Agricultural Experiment Station, Berkeley, California, Bulletin* 331, pp. 81-139, 11 figs., XII tabl. Berkeley, Cal., Oct. 1921.

The resistance of a vine stock to phylloxera not only depends on its chaviour with regard to phylloxera but also on the graft which it bears nd on the climate and soil in which it is grown. Each stock under investigation should consequently be experimented with by grafting on to the best graft and by growing it under various conditions. Work of his kind has been carried out at the California Experimental Station nce 1876. Among the publications of the Station, some thirty treat f phylloxera and vines which resist it; of recent publications the more mportant are *Bulletins* Nos. 127-131-146-148-180-192-187, *Circular* 76 nd the Bulletin which forms the subject of the present abstract. That ulletin gives the results obtained with 21 resistant vine-stocks, some of hem pure American Kinds (Rupestris St. George — R. Martin — R. isgah — Riparia Gloire de Montpellier); others hybrids between various merican Kinds (Rip. × Rup. 101-14 — Rip. × Rup. 3306 — Rip. × up. 3309 — Riparia × Berlandieri 157-11 — Rip. × Berl. 420-A — iparia × Rupestris × Cordifolia 106-8 — Riparia × Rupestris × ndicans 1616 — Rupestris × Candicans = *Vitis Champini*; others ain hybrids between American kinds and *Vitis vinifera* (Aramon × upestris N° 1, N° 2 and N° 9 — Mourvèdre × Rupestris N° 1202 — Chasas × Berlandieri 41-B — Cabernet × Berlandieri 333 E. U. — Bourquon × Rupestris 93-5 — Tokay × Rupestris — Lenoir = *Aestivalis Cinerea* × *Vinifera*).

Stocks recommended for each graft.

Muscat	41-B	420-A	101-14
Corinthe noir	41-B	R. Gloire	A × R. n° 1
Corinthe blanc	3306	St George	—
Sultanina	3309	1202	A × R. n° 1
Sultana	41-B	A × R. n° 1	420-A
Dattier de Beyrouth	A × R n° 9	A × R. n° 1	93-5
Emperor	3309	3306	A × R. n° 1
Cornichon	R. Martin	St. George	41-B
Tokay	41-B	3309	—
Malaga	3309	3306	402-A
Alicante Bouschet	41-B	420-A	—
Gros Mansec	1202	41-B	—
Petit Sirah (Duriff)	3306	420-A	41-B
St. Macaire	41-B	3309	420-A
Lagrein	3309	41-B	1202
Valdepeñas	3309	41-B	—
Semillon	3309	420-A	3306
Palomino	3309	3306	41-B

Most of the results are arranged in tabular form and deal with:— 1) qualities of stocks for growth in nurseries; cost of cuttings; facility of grafting; percentage and completeness of rooting; growth in the nursery; 2) quality of stocks for general growth: character of the grafting union; vigour and longevity of the grafted vine; quality and yield of the crop. Other tables give the best stocks for each graft and the best stocks for general use. An abstract from the former is given in the table above: the first column indicates the best stock, the second the second best stocks and the third column the third best stock. F. D.

1180 - **On the Sensitiveness of Grafted Vines to Frost.** — KROEMER, K. (Geinsenheim), in *Wein und Rebe*, Year 4, No. 4, pp. 188-194. Mainz, Aug. 1, 1922.

This is a general review of the question. Grafted vines are said to be less resistant to frost than non-grafted vines. But in France, CASTEL and others have maintained that grafting on a resistant stock increases the resistance of the variety grafted; GAUTIER has gone so far as to admit that by making a series of grafts the resistance conferred keeps on increasing.

Some experiments show the beneficial effect of stocks on the variety grafted.

According to CERCELET, only a delay in the emission and opening of the buds is caused in such cases, so that they do not suffer from late frosts in spring. However, observations contradicting those mentioned above are not lacking, for example those of OBERLIN. Careful investigations were made in Switzerland by FAES and PORCHET who counted the buds killed by a hard frost in April 1913. From these researches it was found that certain grafted vines suffered less than others which were non-grafted; but the former were young and robust, the latter old and exhausted. Vines of the same age grafted or not had the same power of resistance. As it is difficult in the open vineyard to get absolutely comparable conditions, the writers made experiment with a current of cold air at a temperature of −3° C down to −3.5 C; the stocks were Riparia × Rupestris 11 Dufour; Riparia × Rupestris 3309 C and Mourvèdre × Rupestris 1202 C; the graft was Guetedel de Fontainebleau, the same variety used as a direct producer served as control. The writers took care to make their experiments with vines of the same age and vigour. No appreciable difference was noticed.

FAES has now renewed his experiments on vines at the Lausanne vine growing Station (H. FAES, Gelées d'avril, in *Revue de Viticulture* vol. 56, p. 281, 1922) and has collected them in several tabular statements. From these it appears that differences in resistance to frost should be attributed to age and not to grafting. L. V.

1181 - **Programme of the Swedish State Institute of Experimental Forestry for the Period 1922-26.** — *Meddelanden från statens Skogsforsoksanstalt*, Vol. XIX, No. 1 pp. 66-70. Stockholm 1922.

The Council of the Swedish Institute of Experimental Forestry has approved the programme for the period 1922-26 which decides that